CONTRACT SERIAL NO.
23440-1-9196-01-SQ

CONTRACTOR: NOVAGOLD RESOURCES

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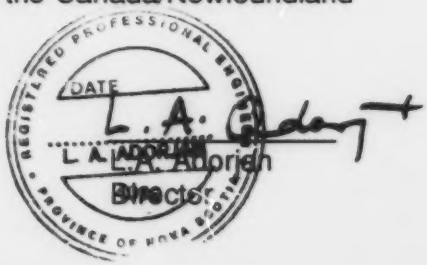
BERESFORD, N.B.

RECOVERY OF GOLD FROM PINE COVE ORE

Subcontract to Minerals Engineering Centre
Technical University of Nova Scotia
by NovaGold Resources Inc.
March 1992

This project was funded by the Canada Centre for Mineral and Energy Technology (CANMET), Energy, Mines and Resources Canada, under the Canada/Newfoundland Co-operating Agreement on Mineral Development.



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SUMMARY

Under the Canada/Newfoundland Co-operation Agreement on Mineral Development funds were made available to Nova Gold Resources Inc. to develop an economically viable and environmentally acceptable process for recovering gold from Pine Cove ore.

The gold in Pine Cove ore can be successfully extracted by cyanidation using agglomeration with vat leaching technique.

Recoveries of 85% and 94% can be obtained when ore is ground to 100% passing 0.15 mm and 63% to 92% passing 0.045 mm, respectively.

With the correct conditions approximately 40% to 50% of the gold will be extracted in the first hour of leaching and 75% to 80% after three hours.

Since ore is alkaline there is no need to add lime for agglomeration, only cement.

Tests show that moisture content for agglomeration is important. This varies from 20% to 28% depending on fineness of grind.

INTRODUCTION

The optimum conditions for the agglomeration of the ore, for the ageing of agglomerates and for leaching at high percolation rates are well established and the economy of the process has been proven for the Murray Brook ore by Murray Brook Resources Incorporated, a wholly owned subsidiary of NovaGold Resources Inc.

The Minerals Engineering Centre was contracted to evaluate the possibility of applying the same technology to the Pine Cove ore.

A 540 kg ore sample, 100% passing 6.3 mm, from Pine Cove, Newfoundland was delivered on October 11,1991, with a sample of waste rock.

After air drying for three days the ore was homogenized and a head sample was collected for analysis by cone and quartering.

METHOD FOR TESTING

Bottle, beaker agglomeration and column cyanidation tests were used to evaluate the ore. Size and chemical analyses of head and tail samples and analyses of leach (pregnant and barren) and wash solutions were carried out. Selected head and tail samples were sent for gold analysis by the fire assay method.

SAMPLE PREPARATION

Samples for bottle tests and column tests on 100% passing 2mm and 1mm were crushed with cone crusher, screened and the over-size was pulverized in a shatter box.

For column tests on samples at 100% passing 0.15 mm, 11 to 11.5 kg samples were ground in a 24" x 15" rod mill at 68 RPM with 20 rods (102 kg) or 32 rods (163 kg).

With 32 rods and 11.5 kg sample the following results were obtained:

Hours Grinding	% Passing 0.045mm
1	70.0
1.5	80.3
2	91.3

Size analyses were carried out with test sieves above 0.045mm and a Malvern Laser Diffraction Size Analyzer was used for subsieve analyses.

TEST WORK

Analysis of head samples

The head samples were dried and analytical samples were prepared and analyzed as shown in Table 1.

Table 1. Analysis of head samples

Head Sample	Au, ppm
Head-1	4.41
Head-2	3.99
Head-3	3.78
Head-4	3.93
Head-5	3.70
Head-6	3.79
Average	3.93

Head Sample: Composite of 1 to 6.

	%		ppm		ppm
SiO2	52.41	Ag	0.60	Mo	10
TiO2	1.74	As	2	Ni	27
Al2O3	11.02	Au	3.75	Pb	12
FeO	8.64	B	23	Rb	24
Fe2O3	1.82	Bi	0.07	Sb	<10
MnO	0.15	Ba	140	Sc	34
MgO	4.29	Cd	0.31	Sn	4
CaO	7.85	Co	33	Sr	250
Na2O	1.07	Cr	53	V	282
K2O	1.10	Cs	2	W	30
P2O5	0.290	Cu	67	Y	31
CO2	6.10	F	360	Zn	101
C (organic)	0.019	Ga	20	Zr	170
H2O-	0.18	Hg	0.018		
H2O+	4.00	Li	25		
S	0.90				
Total Fe as Fe2O3	11.44				

Waste Rock Analysis:

		kg/t	
% S(total)	pH	Acid Producing Potential	Acid Consuming Ability
0.015	9.30	0.46	146

The head sample was size analyzed at fifteen sizes and each fraction was analyzed for gold to assess the grades and distributions of each size fraction as shown in Table 2.

Table 2: Size analysis, grades and distributions of size fractions of head sample.

Size (mm)	% wt.	Au,ppm	Au, % Distribution
+6.30	-	-	-
-6.30 + 4.75	0.84	1.14	0.20
-4.75 + 3.35	9.76	2.45	5.05
-3.35 + 2.36	21.88	4.64	21.43
-2.36 + 1.70	17.95	5.16	19.55
-1.70 + 1.18	11.00	2.32	5.39
-1.18 + 0.85	8.16	3.57	6.15
-0.85 + 0.60	5.68	3.28	3.93
-0.60 + .425	2.76	4.15	2.42
-.425 + 0.30	6.72	7.63	10.83
-0.30 + .212	3.51	7.97	5.91
-.212 + 0.15	2.56	10.30	5.57
-0.15 + .106	2.08	8.35	3.67
-.106 + .075	1.63	8.25	2.84
-.075 + .053	1.46	6.39	1.97
-0.053	4.01	6.01	5.09
Total	100.00		100.00
Cal. Head		4.74	

To test the alkalinity of the ore, a sample was pulverized, mixed with water, cement and lime and pH recorded. Results are shown in Table 3.

Table 3: Alkalinity test of head sample

%	kg/t		
Moisture	Cement	Lime	pH
13	-	-	9.15
13	4.54	-	11.00
13	4.54	7.26	12.00

Bottle Cyanidation Tests

Cyanidation tests were carried out in 10 liter Nalgene bottles. Bottle tests were rotated at 74 RPM on rod mill rolls. The bottles had a 1 cm hole in the cap.

All tests used 1000 g samples and 1.5 L of distilled water.

The ore was tested as received (minus 6.3 mm) and on samples at 100% passing 2.0 mm, 1.0 mm, 0.5 mm, 0.25 mm, 0.15 mm and 0.045 mm.

The samples were conditioned for 5 min. with water. Lime was added and the samples were conditioned for a further 5 min. before adding NaCN. Lime and cyanide were added as required.

Samples were collected every hour, for 8 hours and at 24 hours, to check pH and analyzed for gold and cyanide.

The oxygen level for all tests (except BT-20 & 21) was 5 ppm at start of tests and 3.8 ppm at end of tests.

Bottle Tests-1,2,3,4,5,6 and 15 were used to find what effect feed size had on gold extraction (figure 1). These tests showed a fine grind would be required for adequate gold extraction.

Bottle Tests-4,7,9,10 and 11 were used to find what effect cyanide levels had on gold extraction (figure 2). Higher cyanide levels reduced the time required for gold extraction but with greater cyanide consumption.

Bottle Tests-4,18 and 19 were used to find what effect pH levels had on gold extraction (figure 3) and cyanide consumption (figure 4). The pHs shown are the average pH for 24 hour period. With a starting pH of 11.00 the rate of gold extraction increased. Lower pHs (10.0 to 10.5) had higher cyanide consumption. The optimum starting pH appears to be 11.

Bottle Tests-4,20 and 21 were used to find what effect oxygen levels had on gold extraction (figure 5). To obtain higher oxygen levels, oxygen was bubbled into water before being added to the ore. Tests showed higher oxygen content increased the rate of gold extraction with no effect on cyanide consumption but lime consumption was higher with lower oxygen level.

To obtain a more accurate analysis for column test samples PC-11 Head, PC-12 Tails and PC-15 Tails, Bottle Tests-12,16 and 17 were used.

Bottle Tests-13 and 14 were used to find out if more gold could be extracted from column test PC-11 Tails.

Bottle Test-8 was used to find if keeping cyanide level at starting level would improve gold extraction. Tests showed it did not improve gold extraction and it increased cyanide consumption.

Details for each bottle test are given in Appendix 1. The tables contain lime additions along with pulp pHs. The cyanide additions are shown along with cyanide consumption in kg/t and the total cyanide consumption. The tables give gold in solution, gold extracted and percentage of gold extracted which was determined from calculated head. The calculated head was obtained from gold extracted at end of test and the amount of gold in tails.

Appendix 2 contains size analyses, grades and distributions of size fractions of head and tail samples.

The pregnant solution from Bottle Test-8 was analyzed for elements shown in Table 4.

Table 4: Analysis of pregnant solution, Bottle Test-8

	mg/L
Ag	0.33
As	0.036
Cd	0.012
Co	0.11
Cu	10.30
Fe	30.30
Hg	0.009
Ni	0.14

Figure 1: Effect of Feed Size on Gold Extraction

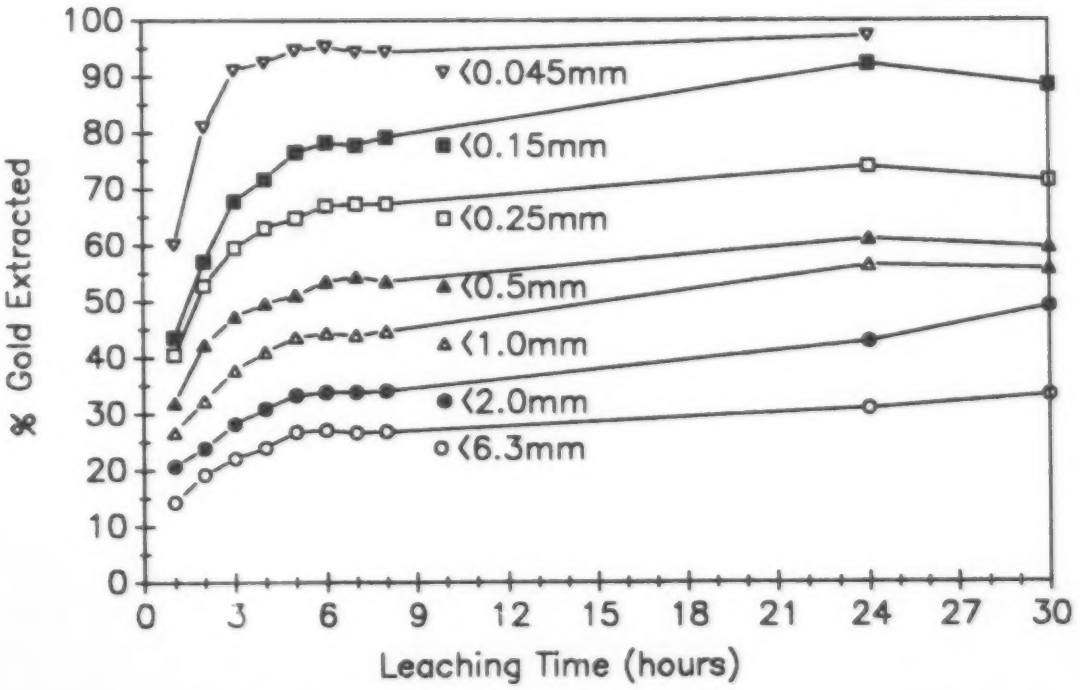


Figure 2: Gold Extraction as Dependent on Free Cyanide Levels

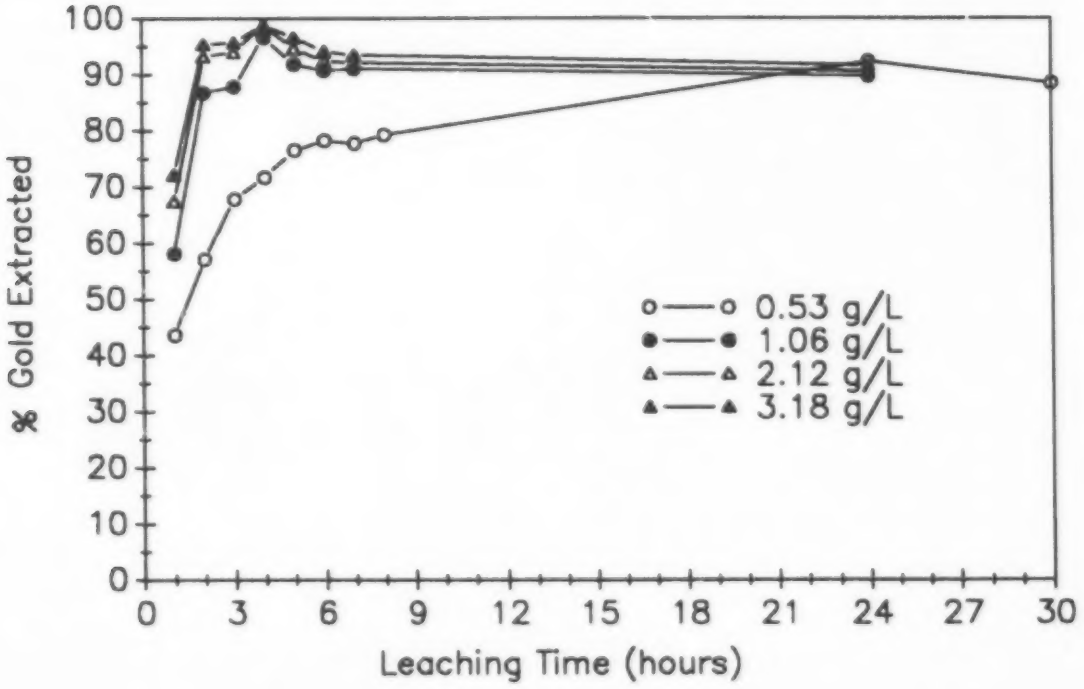


Figure 3: Gold Extraction as Dependent on pH Levels

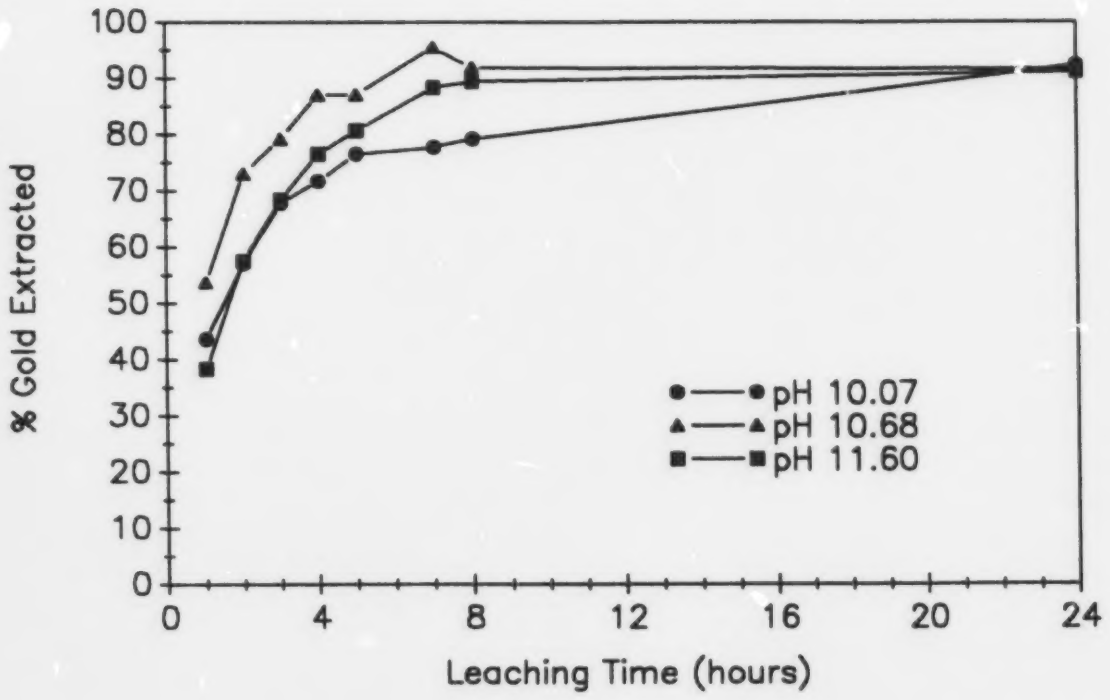


Figure 4: Cumulative NaCN Consumption as Dependent on pH Levels

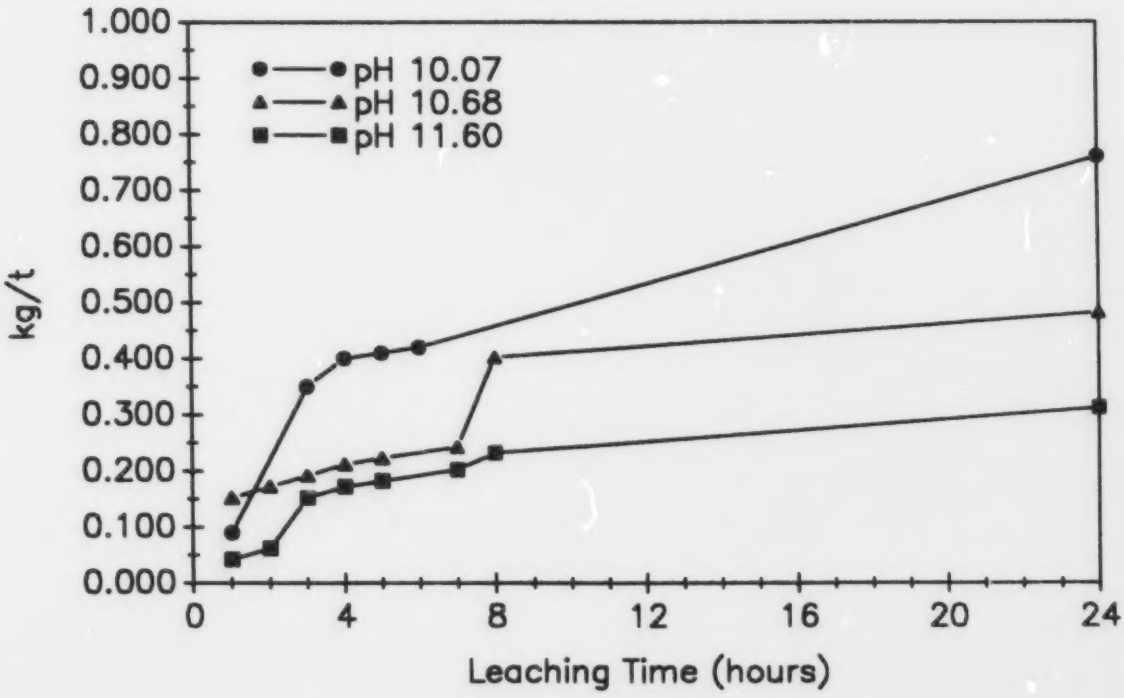
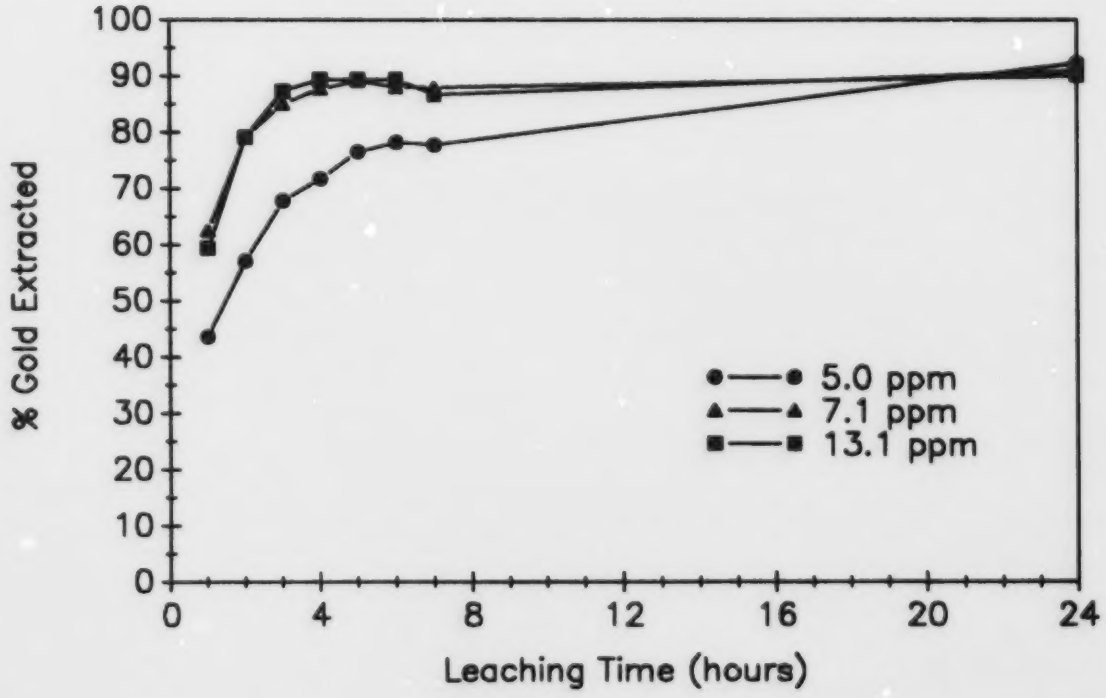


Figure 5: Gold Extraction as Dependent on Oxygen Levels at Start of Test



Column Cyanidation Tests

The column cyanidation tests were carried out in a 120" long by 12.5" diameter column for first test and a 60" long by 4" diameter column was used for remaining tests. Test PC-1 used 227 kg and tests PC-2 to PC-16 used 9 or 10 kg samples.

The ore was tested as received and on samples ground to 100% passing 2 mm and 0.15 mm.

After the ore and cement were mixed for 5 minutes in a roll mill, the mixture was agglomerated with cyanide solution. The agglomerates were placed in column and allowed to cure for periods of 9 to 24 hours.

The leaching started by pumping barren solution into the top of the column with a peristaltic pump. Gold was stripped from pregnant solution with carbon in column attached to bottom of leach column. Samples were collected from discharge of leach and carbon column at various times to measure gold, cyanide, oxygen, temperature and pH. For PC-1 to PC-11 composite pregnant samples were collected every 15 minutes for first hour and sampled every half hour or hour until leaching slowed down and was sampled at end, either 24 to 48 hours. For PC-12 to PC-16 composite samples were collected every 10 minutes for first hour and repeated for each hour (up to 4 hours). After 4 hours samples were collected every hour up to 8 hours of leaching and then at 24 hours.

For the duration of the tests, the agglomerated material was kept flooded and used a flow rate of approximately 10 gal/sq.ft/hour. The column was drained one or two times and reflooded for all tests except PC-9,10,12 and 16.

Previous tests showed adequate gold extraction could be obtained when oxygen level was at 5 ppm. This level was used for column tests since it could be maintained with atmospheric oxygen. When oxygen levels went below 5 ppm, compressed air was bubbled into the barren solution. This was required for all tests except PC-11, 12,15 and 16. Compressed air increased cyanide consumption.

When tests were completed the column was drained and washed 3 to 4 times with water. The agglomerate (Tails) were removed from column and placed into a filter press and washed one more time. The Tails were dried and analyzed for gold. For PC-12, 14, 15 and 16 the Tails were washed for six hours with water at same flow rate as leach solution. The wash solution for each hour was collected, volume recorded and analyzed for NaCN content.

Results and conditions for each column test are shown in Table 5.

Table 6 shows the effect agglomerate size had on gold extraction. The larger size agglomerates were analyzed for gold at end of test. Best recoveries were obtained when the agglomerate size was below 0.8 cm and with the majority below 0.5 cm.

Fire assay results are shown in Table 7.

The effect of percentage minus 0.045 mm had on percent moisture required for agglomeration is shown by Figure 6. The percent moisture varied from 8.5% for 0.88% minus 0.045 mm to 27% for 92.2% minus 0.045 mm and dropped to 25% for 94.16% minus 0.045 mm.

Percentage minus 0.045 mm effect on gold extraction is shown in Figure 7. It compares column tests with bottle tests results. To get good recoveries the ore would have to be ground to 63% minus 0.045 mm.

Column Tests PC-13 and 14 showed the ore could be over ground and produce too much fine material, resulting in low recoveries. Ore used for these tests was reground with steel balls after rod mill. Results of the grind compared to other Head samples is given in Table 8. Beaker agglomeration tests 14A to 14C showed percentage moisture was too high for PC-13 and tests 20A and 20B showed cement levels were too high for PC-14.

Bottle tests indicated the best pH for gold extraction was 10.5 to 11.0 but for column tests the best results were obtained when the pH of the pregnant solution was above 11.6, indicating good penetration of the agglomerate.

Low recoveries were due mainly to grind, percentage moisture, cement levels and size of agglomerate (plus 1 cm). The ore feed for PC-1 to PC-4 was too coarse. Cement levels were too high for PC-5,11,13 and 14. Cement level was too low for PC-6. The percent moisture was too high for PC-13.The agglomerate size was too large for tests PC-5,6,7,9 and 10.

Slight turbidity occurred at start of leaching for some tests but solution cleared very quickly. Turbidity occurred when the column was drained quickly by opening drain value fully and when column was washed with fast flow rates. When column was washed at same flow rate used for leaching only, a small amount of turbidity occurred: Fines migrated to bottom of column with fast flow rates for draining and washing. For PC-16 the column was allowed to drain slowly and agglomerate held shape and no fines migration occurred.

Appendix 3 contains size analyses, grades and distributions of size fractions of Head and Tail samples.

Table 5: Test results and conditions for column test leaching

Column Test	Weight kg	100% Passing	% Minus 0.045 mm	kg/t Cement	Agglomerate, Sol'n % wt.	Agglomerate, Sol'n g/L NaCN
PC-1	226.8	6.3 mm	0.88	4.54	8.5	1.0
PC-2	10	6.3 mm	0.88	4.54	8.5	1.0
PC-3	10	2.0 mm	1.67	4.54	10.0	1.0
PC-4	10	2.0 mm	8.79	4.54	12.8	1.0
PC-5	10	0.15 mm	59.18	11.34	20.0	1.0
PC-6	10	0.15 mm	63.36	9.07	20.0	1.0
PC-7	10	0.15 mm	59.19	11.34	20.0	2.0
PC-8	10	0.15 mm	62.70	11.34	20.0	4.0
PC-9	10	0.15 mm	65.00	11.34	20.0	4.0
PC-10	10	0.15 mm	75.12	11.34	23.5	4.0
PC-11	10	0.15 mm	59.83	11.34	20.0	4.0
PC-12	9	0.15 mm	92.20	11.34	27.0	4.0
PC-13	9	0.15 mm	94.16	11.34	27.5	4.0
PC-14	9	0.15 mm	94.16	11.34	25.0	4.0
PC-15	9	0.15 mm	91.34	11.34	27.0	4.0
PC-16	9	0.15 mm	80.25	11.34	25.0	4.0

Column Test	Hours Cure Time	Leaching Sol'n Liters	Leaching Sol'n g/L NaCN	Leaching Sol'n mL/min. Flow rate	Leaching Time Hr	pH
PC-1	18.75	60	1 (8.5hr) 2(22.5hr)	1000	30	12.10
PC-2	9	20	1.2	290	27	12.05
PC-3	9	20	1.2	208	9 3/4	12.06
PC-4	34	20	1.0	195	47 1/2	11.17
PC-5	20	20	1 (5.5hr) 1.5(66.5hr)	85	72	11.40
PC-6	19.5	15	1.0	70	33	11.40
PC-7	19	15	1.0	71	48	11.46
PC-8	17	15	1.0	61	24	11.66
PC-9	19	15	1.0	64	26 1/2	11.40
PC-10	23.5	15	1.0	75	48	11.40
PC-11	20	15	1.0	66	30	11.50
PC-12	20	16	1.0	84	24	11.70
PC-13	20	15	1.0	64	24	11.01
PC-14	20	15	1.0	66	24	11.32
PC-15	20	15	1.0	67	24	11.89
PC-16	20	15	1.0	70	24	11.90

Flow rates and pHs are average for total leach time

Table 5: Continued

Column Test	Temp,C	Au,ppm Head	Au,ppm Tails	Au, % Extracted	kg/t NaCN Consumption	ppm Oxygen
PC-1	-	4.00	3.17	20.7	0.61	4.46
PC-2	-	4.00	3.00	25.0	0.34	4.52
PC-3	-	4.00	2.50	37.5	0.34	4.12
PC-4	21.60	4.00	2.63	34.2	0.28	3.94
PC-5	22.23	4.00	0.95	76.2	0.41	4.43
PC-6	22.28	6.00	1.53	74.5	0.33	4.88
PC-7	21.35	4.23	0.99	76.6	0.24	4.48
PC-8	21.40	3.80	0.46	87.9	0.32	5.06
PC-9	21.40	3.96	1.20	69.7	0.52	5.15
PC-10	22.40	3.23	0.72	77.7	0.96	4.80
PC-11	21.80	2.52	0.54	78.6	0.74	4.56
PC-12	20.43	4.01	0.26	93.5	0.56	5.22
PC-13	17.60	3.69	1.36	63.1	0.74	5.02
PC-14	18.00	3.69	1.10	70.2	0.73	5.53
PC-15	21.20	3.66	0.24	93.4	0.55	4.82
PC-16	20.40	3.60	0.28	92.2	0.21	5.08

Head for PC-6 was estimated at 6.00 ppm Au.
Head for PC-11 was obtained by Bottle Test #12
Tail for PC-12 was obtained by Bottle Test #16
Tail for PC-15 was obtained by Bottle Test #17

Oxygen and temperature are average for total leach time

Column Test	Ore Height In Column (inchs) When Placed in Col	After Curing	End of Leaching	End of Washing	Turbidity Start of Leaching	Turbidity Start of Washing
PC-1	76.75	76.25	-	-	None	-
PC-2	-	-	-	-	None	-
PC-3	-	-	-	-	None	-
PC-4	26.0	-	-	-	None	-
PC-5	36.5	36.0	-	-	None	-
PC-6	36.5	36.0	-	-	None	-
PC-7	34.75	-	-	-	None	-
PC-8	-	-	-	-	None	-
PC-9	41.5	-	-	-	Slight	-
PC-10	41.0	-	-	-	Slight	-
PC-11	-	-	-	-	None	None
PC-12	46.0	-	42.5	-	Slight	None
PC-13	48.0	47.5	40.5	-	None	A lot
PC-14	47.5	47.5	47.5	-	Slight	None
PC-15	46.5	46.0	43.5	37.25	None	A lot
PC-16	44.5	44.5	41.0	40.5	Slight	A lot

Table 6: Analysis of agglomerate from column tests

	Au,ppm				
	Agglomerate Size (cm)				
Column Test	2.0-2.5	1.4-1.9	1.0-1.4	0.7-1.0	0.2-0.7
PC-5 Tails	2.41	1.55	0.86		
PC-7 Tails		1.70	1.07		
PC-8 Tails		1.76	1.00		
PC-9 Tails	2.33	1.75	2.00	1.12	1.24
PC-10 Tails	1.16	0.63		0.77	
PC-11 Tails		1.28	0.65		1.05
PC-14 Tails			1.87	1.26	1.18
PC-14 Tails (outside of agglomerate)			1.74		
PC-14 Tails (inside of agglomerate)			2.00		

	% Au Extracted				
	Agglomerate Size (cm)				
Column Test	2.0-2.5	1.4-1.9	1.0-1.4	0.7-1.0	0.2-0.7
PC-5 Tails	39.8	60.0	78.5		
PC-7 Tails		59.8	74.7		
PC-8 Tails		53.7	73.7		
PC-9 Tails	41.2	55.8	49.5	71.7	68.7
PC-10 Tails	64.1	80.5		76.2	
PC-11 Tails		49.2	74.2		58.3
PC-14 Tails			49.3	65.9	68.0

Table 7: Results of gold analysis by fire assay method

	Au,ppm		Au, %	Au,ppm	Au, %
Column Test	Head	Tails	Extracted	Tails,Minus * 0.15 mm Fraction	Extracted
PC-5	3.98	0.78	80.4	0.70	82.4
PC-6		1.50	75.0	1.66	72.3
PC-7	3.71	0.77	79.0		
PC-8	3.59	0.49	86.0		
PC-9	2.85	1.07	62.5		
PC-10	2.95	0.55	81.4		
PC-11	2.27	0.47	79.3		
PC-12		0.38	90.6		
PC-14	3.25	1.49	54.2		
PC-15	2.96	0.32	89.2		
PC-16	3.14	0.26	91.7		

* Due to a grinding problem there was some + 0.15 mm material in sample which was removed for this analysis.

Figure 6: Effect of % Minus 0.045mm on % Moisture Required for Agglomeration

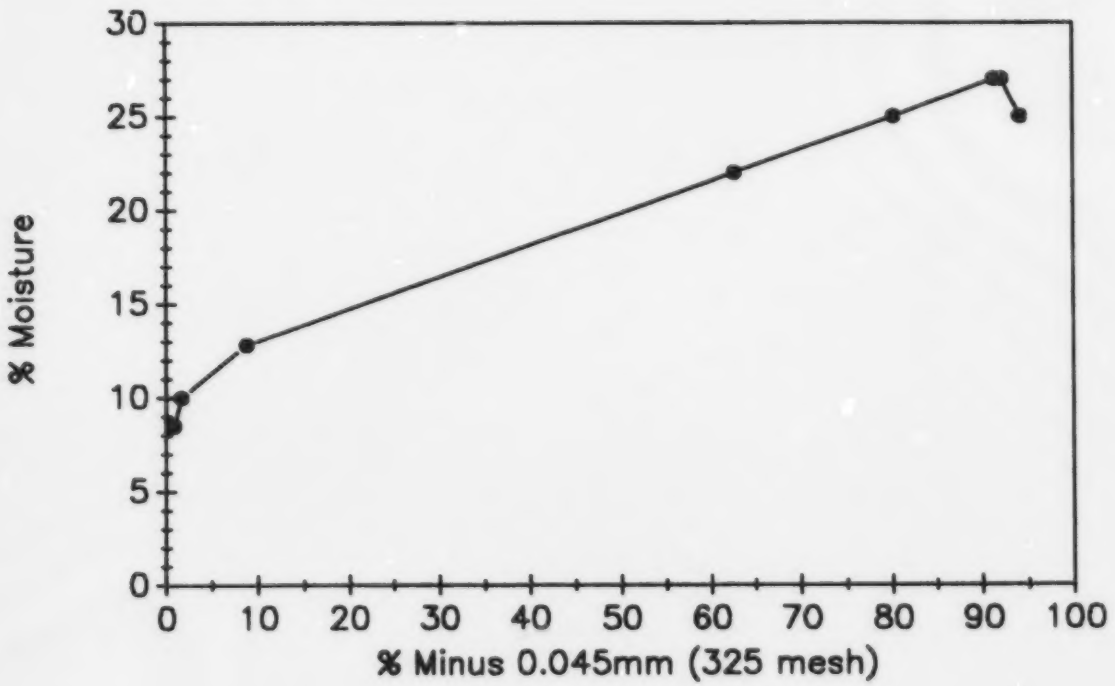


Figure 7: % Minus 0.045mm effect on Gold Extraction

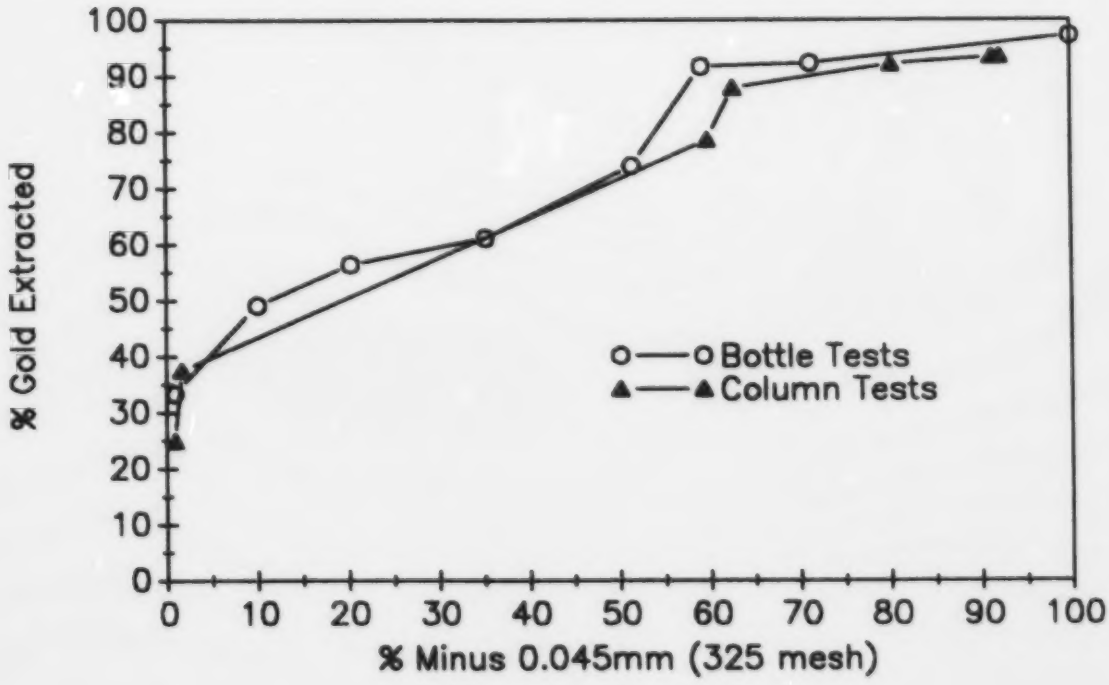


Table 8: Size analysis of head samples.

	Mass, % Finer				
Microns	Bottle Test-15	PC-12	PC-13&14	PC-15	PC-16
150.0	100.0	100.0	100.0	100.0	100.0
45.0	100.0	92.2	94.2	91.3	80.2
27.0	89.9	83.0	89.9	82.0	61.8
15.0	70.3	67.5	77.7	68.7	47.8
9.6	52.3	53.2	64.1	52.1	37.0
6.2	34.9	38.2	48.6	36.7	25.0
4.0	21.4	26.2	35.1	23.8	16.3
1.9	6.0	10.1	14.2	7.9	5.4

The tails from four column tests were washed for six hours with water at same flow rate as leach solution. The wash water was collected after each hour, recorded volume and analyzed for cyanide, results shown in Table 9.

Table 9: Wash water volume and cyanide content

	PC-12		PC-14	
Hours	Vol (mL)	NaCN (ppm)	Vol (mL)	NaCN (ppm)
1	5000	491	3400	468
2	4700	172	3900	269
3	6800	74	3200	197
4	5000	24	3300	124
5	5600	15	3400	97
6	5400	6	3700	49

	PC-15		PC-16	
Hours	Vol (mL)	NaCN (ppm)	Vol (mL)	NaCN (ppm)
1	5000	490	4800	567
2	5600	180	5200	206
3	5800	78	5200	148
4	7200	63	2700	107
5	6800	51	7700	77
6	6500	35	4300	21

The wash solution, column test PC-12, from hour six was analyzed for a few selected elements as shown in Table 10.

Table 10: Analysis of wash solution, column test PC-12.

		mg/L	ppb
pH	11.40		
As		0.014	
Cu		1.05	
Hg			0.23
NaCN		5.6	

For column test PC-16 a composite of the pregnant leach solution was collected for the 24 hour leach period and a sample of the barren solution was taken at the end of test and analyzed for a number of elements as shown in Table 11.

Table 11: Analysis of leach solutions column test PC-16

	PC-16 Preg	PC-16 Barren
Ag (mg/L)	0.19	<0.01
As (mg/L)	0.0063	0.0038
Cd (mg/L)	0.004	0.007
Co (mg/L)	0.06	0.05
Cr (mg/L)	<0.1	<0.1
Cs (mg/L)	<0.02	<0.02
Cu (mg/L)	3.24	2.09
Fe (mg/L)	0.06	0.08
Hg (mg/L)	0.0013	0.0008
Li (mg/L)	<0.01	<0.01
Mn (mg/L)	0.01	<0.01
Ni (mg/L)	0.02	0.04
Pb (mg/L)	<0.02	<0.02
V (mg/L)	<0.1	<0.1
Zn (mg/L)	10.2	14.5

Tails from column tests PC-8 and PC-11 were analyzed for the same elements as Head Sample along with CN analysis by distillation and titration as shown in Table 12.

Table 12: Analysis of tail samples.

	PC-8 Tail	PC-11 Tail
SiO2 (%)	51.56	52.75
TiO2 (%)	1.76	1.74
Al2O3 (%)	11.17	10.95
FeO (%)	1.91	1.42
Fe2O3 (%)	8.59	8.61
MnO (%)	0.18	0.21
MgO (%)	4.37	4.38
CaO (%)	7.73	7.46
Na2O (%)	1.18	1.25
K2O (%)	1.07	1.05
P2O5 (%)	0.28	0.28
CO2 (%)	5.80	5.91
C Organic (%)	0.11	0.05
H2O- (%)	0.11	0.04
H2O+ (%)	3.68	3.69
S (%)	0.91	0.70
Total Fe as Fe2O3 (%)	11.69	11.23
Ag (ppm)	0.20	0.20
As (ppm)	1.3	1.3
Au (ppm)	0.46	0.54
B (ppm)	20	15
Ba (ppm)	110	160
Bi (ppm)	0.07	0.07
Cd (ppm)	0.25	0.2[illegible]
CN (total) (ppm)	3.0	6.25
Co (ppm)	33	29
Cr (ppm)	60	55
Cs (ppm)	3	2
Cu (ppm)	76	63
F (ppm)	340	380
Ga (ppm)	23	24
Hg (ppm)	0.020	0.025
Li (ppm)	23	23
Mo (ppm)	7	6
Ni (ppm)	27	26
Pb (ppm)	11	10
Rb (ppm)	23	25
Sb (ppm)	<7	<7
Sc (ppm)	34	37
Sn (ppm)	5	3
Sr (ppm)	210	220
V (ppm)	284	280
W (ppm)	14	18
Y (ppm)	29	31
Zn (ppm)	154	117
Zr (ppm)	100	130

A water leachate test was carried out on column test tails PC-8 and PC-11. Fifty gram samples were leached with 800 mL water for 24 hours and analyzed for elements shown in Table 13.

Table 13: Analysis of water leachate from column tests tails.

	PC-8 Tails	PC-11 Tails
As (mg/L)	0.01	0.01
CN (mg/L)	0.02	<0.02
Cu (mg/L)	<0.01	<0.01
Hg (mg/L)	0.00032	0.00032

Tests were carried out to see what flow rates could be obtained after agglomerate was washed, results shown in Table 14.

Table 14: High flow rates

Column Test	mL/min	gal/sq.ft/hr.	Comments
PC-12	400	57	Agglomerate broke down
PC-14	15960	2280	Slight turbidity
PC-15	2200	314	Agglomerate broke down

Beaker Agglomeration Tests

Because of problems duplicating column tests results, beaker agglomeration tests were carried out on 100 gram samples using column and bottle test head samples. The ore was mixed with various levels of cement and agglomerated with various amounts of agglomerate solution containing NaCN.

The agglomerate was placed in 150 mL beakers, covered with damp paper towels. After curing for 20 hours the agglomerate was covered for 1 hour with leach solution (1 g/L NaCN). The solution was decanted, volume recorded and analyzed for gold content. This procedure was repeated for second hour on first 11 tests and repeated for third hour and allowed to go for 24 hours on remaining tests. The tails were washed and analyzed for gold.

Tests-1 to 13C were used to check various cement and moisture levels on Head samples at 100%, 72.9% and 62.7% passing 0.045 mm.

Tests-14A to 14C were used to get correct moisture levels for Column test PC-14. Tests-15A to 15C were used to fine correct moisture for Column test PC-15 and Tests-16A to 16C were used to fine correct moisture for PC-16.

Tests-22A to 22G were used to check the effect cure time had on gold extraction, results shown in Figure 8. These tests indicate a cure time of ten hours or greater would be required.

Tests-17A to 17C were used to see what effect different NaCN levels in agglomeration solution had on gold extraction, results shown in Figure 9. Tests-21A to 21C were repeats of 17A to 17C with increased moisture for the 1 and 2 g/L NaCN. Results are shown in Figure 10. In these tests, higher cyanide addition (4g/L or 0.5 Kg/t) resulted in better agglomeration coupled with increased gold extraction. Gold extraction increased for 1 and 2 g/L NaCN solution when moisture content was increased.

Tests-20A and 20B were used to find what effect lower cement levels would have on gold extraction for the grind used for tests PC-13 and 14. These tests showed better recoveries could be obtained, for fine grinds (64.1% minus 9.6 microns), when the cement level was lowered to 9.2 kg/t but results were still lower than obtained on coarser grinds (52% minus 9.6 microns).

Tests-22B and 22E show the effect agglomerate size had on gold extraction, results shown in Figure 11.

Tests-18A to 18E were used to see if cement levels could be lowered with the use of Fly Ash. Tests-19A and 19B were used to see if anhydrite ($CaSO_4$) could lower cement levels. The agglomerate broke down, when cyanide leaching solution was applied to the ore, for all tests except the one with 75% cement and 25% anhydrite.

Appendix 4 contains all the results for beaker agglomeration tests.

Figure 8: Effect of Cure Time on Gold Extraction

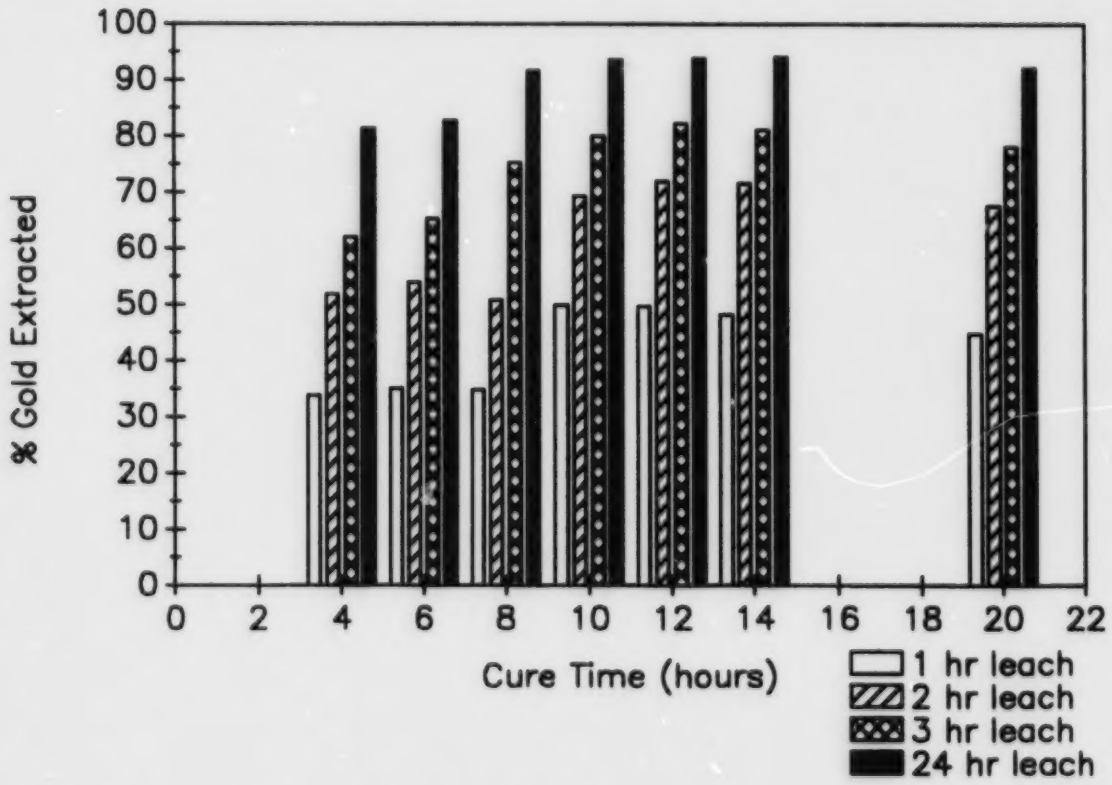


Figure 9: Gold Extraction as Dependent on Free Cyanide Levels of the Solution used for Agglomeration

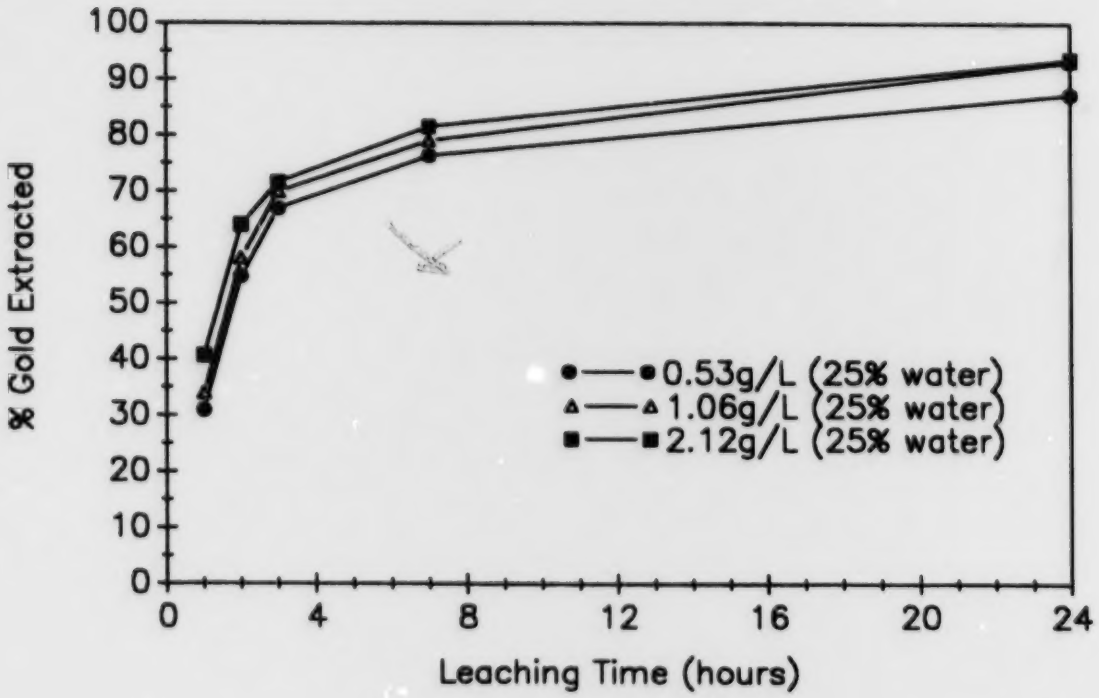


Figure 10: Gold Extraction as Dependent on Free Cyanide Levels of the Solution used for Agglomeration

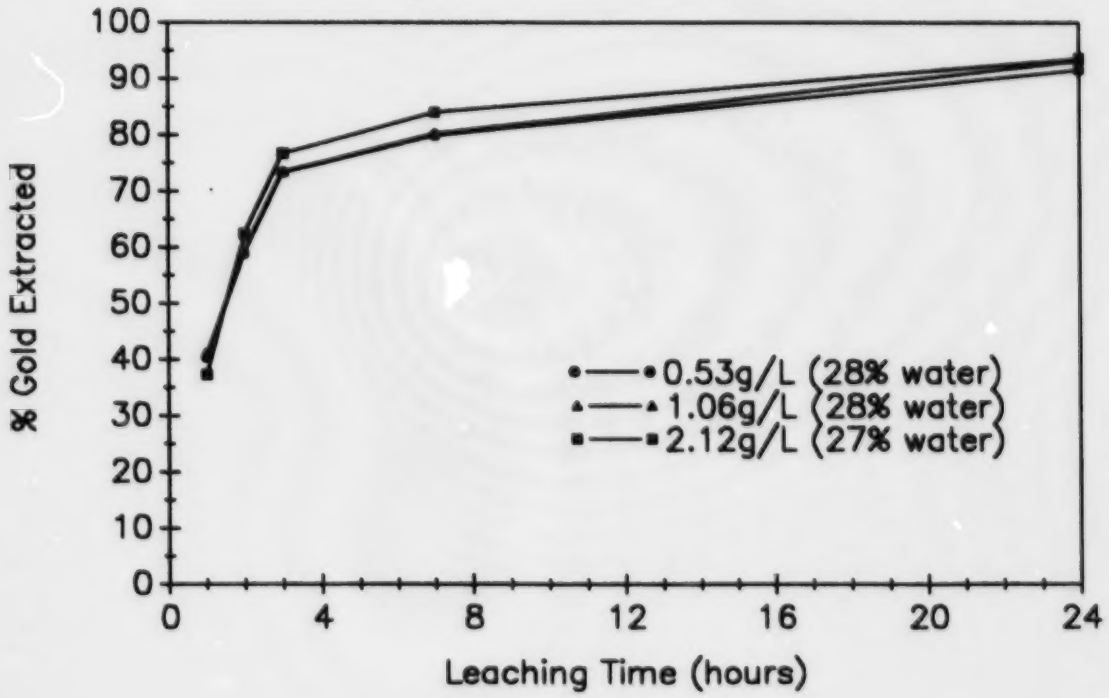
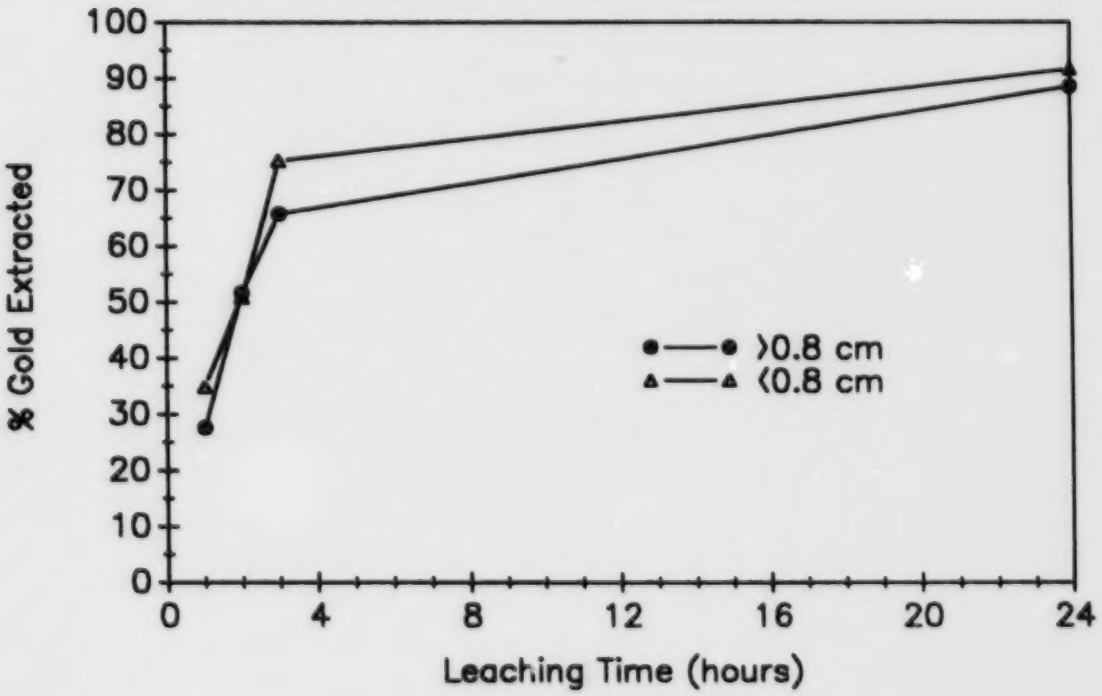


Figure 11: Gold Extraction as Dependent on Agglomerate Size



CONCLUSIONS

1) From the bottle tests we learned the ore would have to be ground to 100% passing 0.15 mm with over 63% passing 0.045 mm to obtain good extraction of the gold (92% to 99%). The column tests confirmed the bottle test results and recoveries of 87.9% to 93.4% were obtained on ore at 63% to 92.2% passing 0.045 mm. Recoveries dropped when 64% of the ore was below 9.6 microns, indicating the ore can be overground.

2) Fire assay results of column tests showed recoveries of 86% to 91.7% could be obtained.

3) Due to the basic condition of the ore no lime was required for agglomeration. Bottle tests indicated the gold extraction increased with a starting pH of 11.0. For column tests the best results were obtained when the pH was above 11.6, indicating good penetration of the agglomerate. No addition of lime was required during column tests as the pH levels remained constant. When pHs were at 10.0 (bottle tests) the sodium cyanide consumption was higher.

4) For agglomeration 11.34 kg/t cement would be required for ore ground at 63% to 92.2% passing 0.045 mm and would require 22% to 27% moisture. Cure times of ten to twenty hours would be required for good recoveries.

5) Gold extraction increased when 4g/L (.5kg/t) sodium cyanide was used for agglomeration. The higher sodium cyanide appears to help in making a better agglomerate. The addition of NaCN during the test did not increase gold extraction.

6) The size of the agglomerate affects the gold recovery. When ball size was above 1.4 cm, only 54% of the gold was extracted. The best recoveries were obtained when the majority of the balls were below 0.5 cm and none was above 0.8 cm.

7) Sodium cyanide consumption was from 0.21 to 0.56 kg/t. When compressed air was bubbled into barren solution, to get higher oxygen levels, the sodium cyanide consumption was 0.7 to 0.9 kg/t.

8) Gold extraction was increased when starting oxygen levels were at 7 ppm and had no effect on sodium cyanide consumption.

APPENDIX 1

Bottle Test #1

Feed: 1000g 100% passing 6.3 mm (as received)

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	NaCN Consumption gram	NaCN Consumption Cum kg/T	pH	Au, ppm Preg Sol'n	Au Extracted ppm	Au Extracted %
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	0.0994	-	-	8.40	-	-	-
10 min.	1500	1.503	-	-	-	10.05	-	-	-
1 hr.	1500	-	-	0.073	0.073	10.10	0.40	0.60	14.3
2 hr.	1475	-	-	0.180	0.253	10.00	0.55	0.81	19.2
3 hr.	1450	-	0.0507	0.040	0.293	9.90	0.64	0.93	22.1
4 hr.	1425	-	0.0575	0.060	0.353	10.00	0.71	1.01	24.0
5 hr.	1400	-	-	0.050	0.403	10.15	0.81	1.13	26.8
6 hr.	1375	-	0.1000	0.020	0.423	10.00	0.83	1.14	27.1
7 hr.	1350	-	-	-	-	10.30	0.83	1.12	26.6
8 hr.	1325	0.514	0.1891	-	-	10.20	0.85	1.13	26.8
24 hr.	1300	-	-	0.574	0.997	9.90	1.00	1.30	30.9
30 hr.	1275	-	-	0.200	1.197	9.70	1.10	1.40	33.3
Total (kg/T)		2.017	0.4967	1.197	1.197				

Au, ppm	
Tails	Cal Head
2.81	4.21

Bottle Test #2

Feed: 1000g 100% passing 2.0 mm

Time	Sol. mL	Addition, grams		NaCN Consumption		pH	Au, ppm Preg Sol'n	Au Extracted	
		NaCN	CaO	gram	Cum kg/T			ppm	%
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	0.0991	-	-	9.10	-	-	-
10 min.	1500	1.518	-	-	-	10.40	-	-	-
1 hr.	1500	-	-	0.088	0.088	10.20	0.61	0.92	20.7
2 hr.	1475	-	-	0.160	0.248	10.10	0.72	1.06	23.9
3 hr.	1450	-	0.0510	0.060	0.308	10.00	0.86	1.25	28.2
4 hr.	1425	-	0.0560	0.030	0.338	10.10	0.96	1.37	30.9
5 hr.	1400	-	-	0.050	0.388	10.30	1.06	1.18	33.3
6 hr.	1375	-	0.0962	0.000	0.388	10.10	1.09	1.50	33.8
7 hr.	1350	-	-	-	-	10.50	1.11	1.50	33.8
8 hr.	1325	0.514	0.1998	-	-	10.40	1.14	1.51	34.0
24 hr.	1300	-	-	0.524	0.912	10.30	1.46	1.90	42.8
30 hr.	1275	-	-	0.000	0.912	10.00	1.71	2.18	49.1
Total (kg/T)		2.013	0.5021	0.912	0.912				

Au, ppm		
Tails	Cal Head	
2.26	4.44	

Bottle Test #3

Feed: 1000g 100% passing 1.0 mm

Time	Sol. mL	Addition, grams		NaCN Consumption			Au, ppm	Au Extracted	
		NaCN	CaO	gram	Cum kg/T	pH	Preg Sol'n	ppm	%
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	0.0964	-	-	9.20	-	-	-
10 min.	1500	1.600	-	-	-	10.10	-	-	-
1 hr.	1500	-	-	0.130	0.130	10.10	0.75	1.13	26.7
2 hr.	1475	-	-	0.170	0.300	10.00	0.93	1.37	32.3
3 hr.	1450	-	0.0534	0.030	0.330	9.90	1.10	1.60	37.7
4 hr.	1425	-	0.0500	0.020	0.350	10.10	1.22	1.74	41.0
5 hr.	1400	-	-	0.050	0.400	10.20	1.32	1.85	43.6
6 hr.	1375	-	0.0986	0.020	0.420	10.00	1.37	1.88	44.3
7 hr.	1350	-	-	-	-	10.40	1.38	1.86	43.9
8 hr.	1325	0.500	0.1810	-	-	10.30	1.43	1.89	44.6
24 hr.	1300	-	-	0.310	0.730	10.70	1.84	2.39	56.4
30 hr.	1275	-	-	0.030	0.760	10.30	1.85	2.35	55.7
Total (kg/T)		2.100	0.4794	0.760	0.760				

Au, ppm	
Tails	Cal Head
1.89	4.24

Bottle Test #4

Feed: 1000g 100% passing 0.15 mm

Time	Sol. mL	Addition, grams		NaCN Consumption		pH	Au, ppm Preg Sol'n	Au Extracted	
		NaCN	CaO	gram	Cum kg/T			ppm	%
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	0.0911	-	-	8.90	-	-	-
10 min.	1500	1.500	0.1490	-	-	9.20	-	-	-
1 hr.	1500	-	0.0525	0.090	0.090	9.90	1.20	1.80	43.6
2 hr.	1475	-	0.0515	-	-	9.90	1.60	2.36	57.1
3 hr.	1450	-	0.0504	0.260	0.350	9.90	1.93	2.80	67.8
4 hr.	1425	-	0.1040	0.050	0.400	9.95	2.08	2.96	71.7
5 hr.	1400	-	-	0.010	0.410	10.20	2.26	3.16	76.5
6 hr.	1375	-	0.0997	0.010	0.420	10.00	2.35	3.23	78.2
7 hr.	1350	-	-	-	-	10.30	2.38	3.21	77.7
8 hr.	1325	0.500	0.2470	-	-	10.20	2.47	3.27	79.2
24 hr.	1300	-	-	0.340	0.760	10.25	2.93	3.81	92.3
30 hr.	1275	-	-	0.030	0.790	10.10	2.86	3.65	88.4
Total (kg/T)		2.000	0.8452	0.790	0.790				

Au, ppm	
Tails	Cal Head
0.48	4.13

Bottle Test #5

Feed: 1000g 100% passing 0.5 mm

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	NaCN Consumption gram	NaCN Consumption Cum kg/T	pH	Au, ppm Preg Sol'n	Au Extracted ppm	Au Extracted %
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	0.1493	-	-	8.80	-	-	-
10 min.	1500	1.510	0.1063	-	-	9.00	-	-	-
1 hr.	1500	-	-	0.140	0.140	10.20	0.87	1.31	31.9
2 hr.	1475	-	-	0.060	0.200	10.10	1.18	1.74	42.3
3 hr.	1450	-	-	0.090	0.290	10.05	1.34	1.94	47.3
4 hr.	1425	-	0.0512	0.020	0.310	10.00	1.43	2.04	49.6
5 hr.	1400	-	0.1001	0.030	0.340	10.00	1.50	2.10	51.1
6 hr.	1375	-	-	0.000	0.340	10.25	1.60	2.20	53.5
7 hr.	1350	-	0.1514	-	-	10.20	1.65	2.23	54.3
8 hr.	1325	0.591	-	-	-	10.70	1.66	2.20	53.5
24 hr.	1300	0.500	0.0998	0.631	0.971	9.90	1.93	2.51	61.1
30 hr.	1275	-	-	0.000	0.971	10.10	1.92	2.45	59.6
Total (kg/T)		2.601	0.6581	0.971	0.971				

Au, ppm	
Tails	Cal Head
1.66	4.11

Bottle Test #6

Feed: 1000g 100% passing 0.25 mm

Time	Sol. mL	Addition, grams		NaCN Consumption		pH	Au, ppm Preg Sol'n	Au Extracted	
		NaCN	CaO	gram	Cum kg/T			ppm	%
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	0.1499	-	-	8.80	-	-	-
10 min.	1500	1.515	0.2003	-	-	9.60	-	-	-
1 hr.	1500	-	-	0.145	0.145	10.20	1.08	1.62	40.5
2 hr.	1475	-	-	0.030	0.175	10.10	1.43	2.11	52.8
3 hr.	1450	-	-	0.070	0.245	10.10	1.64	2.38	59.5
4 hr.	1425	-	0.0500	0.020	0.265	10.00	1.77	2.52	63.0
5 hr.	1400	-	0.1030	0.070	0.335	10.10	1.85	2.59	64.8
6 hr.	1375	-	-	0.020	0.355	10.30	1.95	2.68	67.0
7 hr.	1350	-	0.1488	-	-	10.25	1.99	2.69	67.3
8 hr.	1325	0.510	-	-	-	10.70	2.03	2.69	67.3
24 hr.	1300	0.493	0.1000	0.460	0.815	9.95	2.28	2.96	74.0
30 hr.	1275	-	-	0.013	0.828	10.10	2.24	2.86	71.5
Total (kg/T)		2.518	0.7520	0.828	0.828				

Au, ppm	
Tails	Cal Head
1.14	4.00

Bottle Test #7

Feed: 1000g 100% passing 1.0 mm

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	NaCN Consumption gram	NaCN Consumption Cum kg/T	pH	Au, ppm Preg Sol'n	Au Extracted ppm	Au Extracted %
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	0.1501	-	-	8.90	-	-	-
10 min.	1500	10.500	-	-	-	10.10	-	-	-
1 hr.	1500	-	-	1.670	1.670	10.50	1.13	1.70	42.6
2 hr.	1475	-	-	0.150	1.820	10.40	1.35	1.99	49.9
3 hr.	1450	-	-	0.210	2.030	10.40	1.46	2.12	53.1
4 hr.	1425	-	-	0.080	2.110	10.40	1.54	2.19	54.9
5 hr.	1400	-	-	0.410	2.520	10.40	1.53	2.14	53.6
6 hr.	1375	-	-	0.140	2.660	10.40	1.66	2.28	57.1
7 hr.	1350	-	-	-	-	10.40	1.71	2.31	57.9
8 hr.	1325	-	-	-	-	10.40	1.67	2.21	55.4
24 hr.	1300	-	-	1.090	3.750	10.35	1.90	2.47	61.9
30 hr.	1275	-	-	0.000	3.750	10.35	1.90	2.42	60.7
Total (kg/T)		10.500	0.1501	3.750	3.750				

Au, ppm	
Tails	Cal Head
1.57	3.99

Bottle Test #8

Feed: 1000g 100% passing 0.15 mm

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	NaCN Consumption gram	NaCN Consumption Cum kg/T	pH	Au, ppm Preg Sol'n	Au Extracted ppm	Au Extracted %
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	0.2512	-	-	8.90	-	-	-
10 min.	1500	1.500	-	-	-	10.10	-	-	-
1 hr.	1500	-	0.1502	0.250	0.250	9.90	1.22	1.83	54.0
2 hr.	1475	0.237	-	0.010	0.260	10.20	1.55	2.29	67.6
3 hr.	1450	-	-	0.147	0.407	10.10	1.74	2.52	74.3
4 hr.	1425	0.159	-	0.030	0.437	10.05	1.90	2.71	79.9
5 hr.	1400	0.211	-	0.039	0.476	10.10	2.12	2.97	87.6
6 hr.	1375	-	-	0.131	0.607	10.10	2.21	3.04	89.7
7 hr.	1350	-	-	0.100	0.707	10.05	2.24	3.02	89.1
8 hr.	1325	0.300	0.1752	0.250	0.957	10.00	2.26	3.00	88.5
24 hr.	1300	-	-	0.070	1.027	10.10	2.39	3.11	91.7
30 hr.	1275	-	-	0.030	1.057	10.00	2.26	2.88	85.0
Total (kg/T)		2.407	0.5766	1.057	1.057				

Au, ppm	
Tails	Cal Head
0.51	3.39

Bottle Test #9

Feed: 1000g 100% passing 0.15 mm

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	NaCN Consumption gram	NaCN Consumption Cum kg/T	pH	Au, ppm Preg Sol'n	Au Extracted ppm	Au Extracted %
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	0.2571	-	-	8.80	-	-	-
10 min.	1500	3.000	-	-	-	10.10	-	-	-
1 hr.	1500	-	0.1476	2.80	0.20	10.10	1.46	2.19	58.1
2 hr.	1475	-	-	2.39	0.61	10.30	2.22	3.27	86.7
3 hr.	1450	-	-	2.35	0.65	10.40	2.28	3.31	87.8
4 hr.	1425	-	-	2.30	0.70	10.40	2.60	3.64	96.6
5 hr.	1400	-	-	2.20	0.80	10.40	2.47	3.46	91.8
6 hr.	1375	-	-	2.16	0.84	10.40	2.49	3.42	90.7
7 hr.	1350	-	-	2.12	0.88	10.40	2.54	3.43	91.0
24 hr.	1325	-	-	1.56	1.44	10.20	2.55	3.38	89.7
Total (kg/T)		3.000	0.4047	1.44	1.44				

Au, ppm	
Tails	Cal Head
0.39	3.77

Bottle Test #10

Feed: 1000g 100% passing 0.15 mm

Time	Sol. mL	Addition, grams		NaCN Consumption			Au, ppm	Au Extracted	
		NaCN	CaO	gram	Cum kg/T	pH	Preg Sol'n	ppm	%
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	0.2494	-	-	8.90	-	-	-
10 min.	1500	6.000	-	-	-	10.10	-	-	-
1 hr.	1500	-	-	5.30	0.70	10.30	1.66	2.49	67.5
2 hr.	1475	-	-	4.42	1.58	10.35	2.33	3.44	93.2
3 hr.	1450	-	-	4.37	1.63	10.50	2.39	3.47	94.0
4 hr.	1425	-	-	4.25	1.75	10.60	2.60	3.65	98.9
5 hr.	1400	-	-	4.20	1.80	10.60	2.49	3.49	94.6
6 hr.	1375	-	-	4.15	1.85	10.65	2.48	3.41	92.4
7 hr.	1350	-	-	4.11	1.89	10.60	2.52	3.40	92.1
24 hr.	1325	-	-	3.51	2.49	10.55	2.52	3.34	90.5
Total (kg/T)		6.000	0.2494	2.49	2.49				

Au, ppm	
Tails	Cal Head
0.35	3.69

Bottle Test #11

Feed: 1000g 100% passing 0.15 mm

Time	Sol. mL	Addition, grams		NaCN Consumption		pH	Au, ppm Preg Sol'n	Au Extracted	
		NaCN	CaO	gram	Cum kg/T			ppm	%
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	0.2406	-	-	8.90	-	-	-
10 min.	1500	9.000	-	-	-	10.10	-	-	-
1 hr.	1500	-	-	8.10	0.90	10.50	1.78	2.67	72.2
2 hr.	1475	-	-	7.79	1.21	10.50	2.39	3.53	95.4
3 hr.	1450	-	-	7.05	1.95	10.70	2.44	3.54	95.7
4 hr.	1425	-	-	6.80	2.20	10.80	2.63	3.65	98.9
5 hr.	1400	-	-	6.70	2.30	10.80	2.55	3.57	96.6
6 hr.	1375	-	-	6.61	2.39	10.80	2.53	3.48	94.1
7 hr.	1350	-	-	6.43	2.57	10.80	2.56	3.46	93.5
24 hr.	1325	-	-	5.59	3.41	10.90	2.56	3.39	91.6
Total (kg/T)		9.000	0.2406	3.41	3.41				

Au, ppm	
Tails	Cal Head
0.31	3.70

Bottle Test #12

Feed: 100g PC-11 Head, 100% passing 0.15 mm

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	pH	Au, ppm Preg Sol'n	Au, ppm Extracted
Start	162	-	-	-	-	-
5 min.	162	0.3160	0.0243	9.35	-	-
1 hr.	162	-	-	10.10	1.15	1.86
2 hr.	157	-	-	10.10	1.30	2.10
3 hr.	152	-	-	10.05	1.47	2.30
4 hr.	147	-	-	10.10	1.52	2.31
5 hr.	142	-	-	10.10	1.57	2.31

Au, ppm	
Tails	Cal Head
0.21	2.52

Bottle Test #13

Feed: 1000g PC-11 Tails (pulverized), 100% passing 0.15 mm

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	pH	Au, ppm Preg Sol'n	Au, ppm Extracted
Start	1500	-	-	-	-	-
5 min.	1500	3.0500	-	11.40	-	-
1 hr.	1500	-	-	11.40	0.13	0.20
2 hr.	1495	-	-	11.40	0.16	0.24
3 hr.	1490	-	-	11.40	0.18	0.27
4 hr.	1485	-	-	11.40	0.19	0.28
5 hr.	1480	-	-	11.40	0.21	0.31

Au, ppm	
Tails	Cal Head
0.28	0.59

Bottle Test #14

Feed: 1000g PC-11 Tails, 100% passing 0.15 mm

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	pH	Au, ppm Preg Sol'n	Au, ppm Extracted
Start	1500	-	-	-	-	-
5 min.	1500	3.0280	-	11.50	-	-
1 hr.	1500	-	-	11.50	0.11	0.17
2 hr.	1495	-	-	11.50	0.14	0.21
3 hr.	1490	-	-	11.50	0.16	0.24
4 hr.	1485	-	-	11.50	0.17	0.25
5 hr.	1480	-	-	11.50	0.17	0.25

Au, ppm		
Tails	Cal Head	
0.26	0.51	

Bottle Test #15

Feed: 1000g 100% passing 0.045mm

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	NaCN Consumption gram	NaCN Consumption Cum kg/T	pH	Au, ppm Preg Sol'n	Au Extracted ppm	Au Extracted %
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	1.515	0.3010	-	-	9.30	-	-	-
1 hr.	1500	-	0.1040	0.335	0.335	9.90	1.43	2.15	60.1
2 hr.	1480	-	0.3053	0.020	0.355	9.85	1.96	2.90	81.0
3 hr.	1460	-	-	0.010	0.365	10.00	2.23	3.26	91.1
4 hr.	1445	-	-	0.020	0.385	10.00	2.29	3.31	92.5
5 hr.	1430	-	0.2056	-	-	9.90	2.37	3.39	94.7
6 hr.	1410	-	-	0.040	0.425	10.10	2.42	3.41	95.3
7 hr.	1390	-	-	0.010	0.435	10.00	2.43	3.38	94.4
8 hr.	1375	0.809	0.3360	0.150	0.585	9.90	2.46	3.38	94.4
24 hr.	1360	-	-	0.409	0.994	10.25	2.56	3.48	97.2
Total (kg/T)		2.324	1.25[illegible]9	0.994	0.994				

Au, ppm	
Tails	Cal Head
0.10	3.58

Bottle Test #16

Feed: 1000g PC-12 Tails, 100% passing 0.15 mm

Time	Sol. mL	Addition, grams NaCN	CaO	pH	Au, ppm Preg Sol'n	Au, ppm Extracted
Start	1500	-	-	-	-	-
5 min.	1500	3.0250	-	10.00	-	-
19 hr.	1490	-	-	10.70	0.10	0.15

Au, ppm	
Tails	Cal Head
0.11	0.26

Bottle Test #17

Feed: 1000g PC-15 Tails, 100% passing 0.15 mm

Time	Sol. mL	Addition, grams NaCN	CaO	pH	Au, ppm Preg Sol'n	Au, ppm Extracted
Start	1500	-	-	-	-	-
5 min.	1500	3.0070	-	10.80	-	-
1 hr.	1500	-	-	11.10	0.03	0.05
2 hr.	1495	-	-	11.20	0.04	0.06
3 hr.	1490	-	-	11.20	0.05	0.075
4 hr.	1485	-	-	11.30	0.05	0.074
7 hr.	1480	-	-	11.10	0.06	0.089
24 hr.	1475	-	-	10.90	0.08	0.120

Au, ppm	
Tails	Cal Head
0.12	0.24

Bottle Test #18

Feed: 1000g 100% passing 0.15mm

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	NaCN Consumption gram	NaCN Consumption Cum kg/T	pH	Au, ppm Preg Sol'n	Au Extracted ppm	Au Extracted %
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	0.5591	-	-	9.10	-	-	-
10 min.	1500	1.552	-	-	-	11.00	-	-	-
1 hr.	1500	-	0.1000	0.152	0.152	10.75	1.27	1.91	53.7
2 hr.	1480	-	-	0.020	0.172	10.90	1.76	2.60	73.0
3 hr.	1460	-	-	0.020	0.192	10.85	1.93	2.82	79.2
4 hr.	1445	-	-	0.020	0.212	10.75	2.15	3.10	87.1
5 hr.	1430	-	-	0.010	0.222	10.60	2.18	3.10	87.1
7 hr.	1390	-	-	0.020	0.242	10.45	2.43	3.40	95.5
8 hr.	1375	-	0.1088	0.160	0.402	10.40	2.37	3.27	91.9
24 hr.	1360	-	-	0.080	0.482	10.40	2.40	3.26	91.6
Total (kg/T)		1.552	0.7679	0.482	0.482				

Au, ppm Tails	Au, ppm Cal Head
0.30	3.56

Bottle Test #19

Feed: 1000g 100% passing 0.15mm

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	NaCN Consumption gram	NaCN Consumption Cum kg/T	pH	Au, ppm Preg Sol'n	Au Extracted ppm	Au Extracted %
Start	1500	-	-	-	-	-	-	-	-
5 min.	1500	-	1.1027	-	-	9.10	-	-	-
10 min.	1500	1.512	0.2056	-	-	11.65	-	-	-
1 hr.	1500	-	-	0.042	0.042	11.90	0.91	1.37	38.3
2 hr.	1480	-	-	0.020	0.062	11.90	1.39	2.06	57.5
3 hr.	1460	-	-	0.090	0.152	11.75	1.68	2.45	68.4
4 hr.	1445	-	-	0.020	0.172	11.75	1.90	2.74	76.5
5 hr.	1430	-	-	0.010	0.182	11.60	2.04	2.89	80.7
7 hr.	1390	-	-	0.020	0.202	11.50	2.26	3.16	88.3
8 hr.	1375	-	0.1064	0.030	0.232	11.35	2.32	3.20	89.4
24 hr.	1360	-	-	0.080	0.312	11.00	2.40	3.26	91.1
Total (kg/T)		1.512	1.4147	0.312	0.312				

Au, ppm Tails	Au, ppm Cal Head
0.30	3.56

Bottle Test #20

Feed: 500g 100% passing 0.15mm

Oxygen: Start 7.1 ppm. End 4.9 ppm

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	NaCN Consumption gram	NaCN Consumption Cum kg/T	pH	Au, ppm Preg Sol'n	Au Extracted ppm	Au Extracted %
Start	750	0.7500	0.1330	-	-	-	-	-	-
1 hr.	750	-	-	0.090	0.180	10.40	1.42	2.13	62.5
2 hr.	730	-	-	0.020	0.220	10.20	1.85	2.70	79.2
3 hr.	710	-	-	0.010	0.240	10.20	2.04	2.90	85.0
4 hr.	690	-	-	0.050	0.340	10.10	2.17	2.99	87.7
5 hr.	670	-	-	0.050	0.440	10.10	2.27	3.04	89.1
6 hr.	650	-	-	0.020	0.480	10.05	2.31	3.00	88.0
7 hr.	630	-	0.0955	0.050	0.580	10.00	2.38	3.00	88.0
24 hr.	610	-	-	0.100	0.780	10.00	2.52	3.07	90.0
Total (kg/T)		1.500	0.4570	0.780	0.780				

Au, ppm Tails	Au, ppm Cal Head
0.34	3.41

Bottle Test #21

Feed: 500g 100% passing 0.15mm

Oxygen: Start 13.1 ppm. End 5.4 ppm

Time	Sol. mL	Addition, grams NaCN	Addition, grams CaO	NaCN Consumption gram	NaCN Consumption Cum kg/T	pH	Au, ppm Preg Sol'n	Au Extracted ppm	Au Extracted %
Start	750	0.7510	0.1129	-	-	-	-	-	-
1 hr.	750	-	-	0.091	0.182	10.40	1.31	1.96	59.4
2 hr.	730	-	-	0.020	0.222	10.20	1.79	2.61	79.1
3 hr.	710	-	-	0.080	0.382	10.10	2.03	2.88	87.3
4 hr.	690	-	-	0.020	0.422	10.10	2.14	2.95	89.4
5 hr.	670	-	-	0.010	0.442	10.00	2.20	2.95	89.4
6 hr.	650	-	-	0.060	0.562	10.00	2.27	2.95	89.4
7 hr.	630	-	0.0926	0.010	0.582	9.90	2.27	2.86	86.7
24 hr.	610	-	-	0.070	0.722	10.00	2.46	3.00	90.9
Total (kg/T)		1.502	0.4116	0.722	0.722				

Au, ppm Tails	Au, ppm Cal Head
0.30	3.30

APPENDIX 2

SIZE ANALYSIS: Bottle Cyanidation Tests

Bottle Test-1

Size (mm)	% wt. Tails	Au,ppm Tails	Au,% Distribution Tails
+ 2.0	38.14	2.50	44.01
-2.0 + 1.0	27.56	2.60	33.07
-1.0 + 0.5	13.75	1.60	10.15
-0.5 + .25	9.33	1.70	7.32
-.25 + .15	5.13	1.70	4.02
-.15 + .106	2.40	0.85	0.94
-.106 + .075	1.52	0.28	0.20
-.075 + .053	1.00	0.23	0.11
-.053 + .045	0.29	0.55	0.07
-0.045	0.88	0.26	0.11
	100.00		100.00
	Cal. Head	2.17	

Bottle Test-2

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ 1.0	38.66	32.80	3.05	2.40	26.99	37.62
-1.0 + 0.5	20.70	19.37	3.60	2.20	17.06	20.36
-0.5 + .25	14.70	15.23	4.65	2.90	15.65	21.11
-.25 + .15	6.81	7.40	7.54	3.90	11.75	13.79
-.15 + .106	3.46	4.01	6.16	1.68	4.88	3.22
-.106 + .075	2.54	2.70	6.68	0.81	3.88	1.05
-.075 + .053	2.01	1.93	4.49	0.45	2.06	0.42
-.053 + .045	1.11	0.27	2.12	0.72	0.54	0.09
-0.045	10.01	16.29	7.50	0.30	17.19	2.34
	100.00	100.00			100.00	100.00
		Cal. Head	4.37	2.09		

Bottle Test-3

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ 0.5	24.75	22.16	2.44	3.95	14.46	48.60
-0.5 + .25	25.94	24.16	3.59	1.60	22.29	21.46
-.25 + .15	12.38	11.90	5.86	2.40	17.36	15.86
-.15 + .106	6.29	6.38	5.07	1.05	7.63	3.72
-.106 + .075	4.55	4.28	4.57	0.55	4.98	1.30
-.075 + .053	3.78	3.63	3.16	0.25	2.86	0.51
-.053 + .045	2.01	1.11	1.94	0.80	0.93	0.49
-0.045	20.30	26.38	6.07	0.55	29.49	8.06
	100.00	100.00			100.00	100.00
		Cal. Head	4.18	1.80		

Bottle Test-4

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ .106	3.18	3.00	6.04	2.03	5.10	18.33
-.106 + .075	8.82	8.36	6.34	1.12	14.84	28.17
-.075 + .053	10.55	10.13	4.75	0.84	13.30	25.62
-.053 + .045	6.16	6.07	6.47	0.57	10.58	10.42
-0.045	71.29	72.44	2.97	0.08	56.18	17.46
	100.00	100.00			100.00	100.00
		Cal. Head	3.77	0.33		

Bottle Test-5

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ .25	26.87	26.72	3.45	1.40	26.83	36.30
-.25 + .15	16.00	15.78	5.33	2.20	24.69	33.69
-.15 + .106	8.98	8.64	5.40	1.60	14.04	13.41
-.106 + .075	6.01	5.67	4.69	1.10	8.16	6.05
-.075 + .053	5.19	4.88	4.36	0.94	6.55	4.45
-.053 + .045	1.74	1.66	3.76	0.47	1.89	0.76
-0.045	35.21	36.65	1.75	0.15	17.84	5.34
	100.00	100.00			100.00	100.00
		Cal. Head	3.46	1.03		

Bottle Test-6

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ .15	15.63	17.16	5.95	2.20	26.23	47.59
-.15 + .106	13.28	13.57	4.75	1.55	17.79	26.51
-.106 + .075	9.17	8.94	5.13	1.10	13.27	12.39
-.075 + .053	7.95	7.77	4.71	0.65	10.56	6.37
-.053 + .045	2.53	2.41	3.58	0.48	2.55	1.46
-0.045	51.44	50.15	2.04	0.09	29.60	5.68
	100.00	100.00			100.00	100.00
		Cal. Head	3.55	0.79		

Bottle Test-7

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ 0.5	24.75	25.62	2.44	1.95	14.46	39.83
-0.5 + .25	25.94	21.76	3.59	1.45	22.29	25.15
-.25 + .15	12.38	11.16	5.86	1.95	17.36	17.35
-.15 + .106	6.29	6.26	5.67	1.85	7.63	9.23
-.106 + .075	4.55	4.07	4.57	1.13	4.98	3.67
-.075 + .053	3.78	3.42	3.16	0.79	2.86	2.15
-.053 + .045	2.01	1.18	1.94	0.99	0.93	0.93
-0.045	20.30	26.53	6.07	0.08	29.49	1.69
	100.00	100.00			100.00	100.00
		Cal. Head	4.18	1.25		

Bottle Test-8

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ .106	11.59	11.70	3.95	1.27	13.33	31.78
-.106 + .075	13.45	13.29	3.86	1.15	15.12	32.68
-.075 + .053	10.38	10.44	6.00	0.67	18.13	15.10
-.053 + .045	5.39	5.23	5.49	0.58	8.62	6.48
-0.045	59.19	59.34	2.60	0.11	44.80	13.96
	100.00	100.00			100.00	100.00
		Cal. Head	3.44	0.47		

Bottle Tests-9,10,11,18,19,20 & 21

Size (mm)	% wt. Head	Au,ppm Head	Au,% Distribution Head
+ .106	2.92	3.95	13.33
-.106 + .075	8.32	3.86	15.12
-.075 + .053	12.41	6.00	18.13
-.053 + .045	3.41	5.49	8.62
-0.045	72.94	2.60	44.80
	100.00		100.00
	Cal. Head	3.27	

APPENDIX 3

PC-2 Tails

Size (mm)	% wt.	Au, ppm	Au, % Distribution
+ 2.36	35.33	4.16	42.90
-2.36 + 1.18	29.90	2.73	23.90
-1.18 + .425	17.47	3.63	18.50
-.425 + .212	6.66	4.29	8.30
-.212 + .15	1.90	3.10	1.70
-.15 + .075	2.81	3.18	2.60
-.075 + .053	1.13	1.64	0.60
-0.053	4.80	1.07	1.50
	100.00		100.00
	Cal Head	3.42	

Column Test PC-3

	% wt.	Au,ppm	Au,% Distribution
Size (mm)	Tails	Tails	Tails
+ 1.0	56.97	1.70	53.45
-1.0 + 0.5	16.15	1.80	16.04
-0.5 + .25	8.28	2.60	11.88
-.25 + .15	4.48	3.83	9.47
-.15 + .106	2.99	2.79	4.60
-.106 + .075	3.04	1.33	2.23
-.075 + .053	6.12	0.50	1.69
-.053 + .045	0.30	0.56	0.09
-0.045	1.67	0.60	0.55
	100.00		100.00
	Cal. Head	1.8100	

Column Test PC-4

	% wt.	Au,ppm	Au,% Distribution
Size (mm)	Tails	Tails	Tails
+ 1.0	48.29	1.60	52.47
-1.0 + 0.5	16.94	1.40	16.11
-0.5 + .25	5.63	2.70	10.32
-.25 + .15	5.98	2.75	11.17
-.15 + .106	3.57	1.77	4.29
-.106 + .075	4.95	0.46	1.55
-.075 + .053	5.53	0.65	2.44
-.053 + .045	0.32	0.20	0.04
-0.045	8.79	0.27	1.61
	100.00		100.00
	Cal. Head	1.47	

Column Test PC-5

Size (mm)	% wt. Tails	Au,ppm Tails	Au,% Distribution Tails
+ .106	11.88	2.25	35.72
-.106 + .075	12.48	1.35	22.51
-.075 + .053	10.96	1.10	16.11
-.053 + .045	5.50	0.80	5.88
-0.045	59.18	0.25	19.78
	100.00		100.00
	Cal. Head	0.75	

Column Test PC-6

Size (mm)	% wt. Tails	Au,ppm Tails	Au,% Distribution Tails
+ .106	9.17	3.85	31.75
-.106 + .075	11.40	2.04	20.92
-.075 + .053	10.67	1.35	12.95
-.053 + .045	5.40	1.80	8.74
-0.045	63.36	0.45	25.64
	100.00		100.00
	Cal. Head	1.11	

Column Test PC-7

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ .106	11.59	11.82	3.95	1.45	13.33	22.46
-.106 + .075	13.45	13.68	3.86	1.55	15.12	27.78
-.075 + .053	10.38	11.11	6.00	1.80	18.13	26.21
-.053 + .045	5.39	5.12	5.49	1.35	8.62	9.05
-0.045	59.19	58.27	2.60	0.19	44.80	14.50
	100.00	100.00			100.00	100.00
	Cal. Head		3.43	0.76		

Column Test PC-8

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ .106	8.04	11.41	4.73	1.35	10.65	30.20
-.106 + .075	11.90	12.67	5.04	1.10	16.80	27.33
-.075 + .053	11.29	11.16	5.02	0.85	15.87	18.61
-.053 + .045	6.07	3.28	4.94	0.90	8.40	5.78
-0.045	62.70	61.48	2.75	0.15	48.28	18.08
	100.00	100.00			100.00	100.00
	Cal. Head		3.57	0.51		

Column Test PC-9

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ .106	9.05	12.13	6.14	1.58	12.43	20.35
-.106 + .075	11.51	12.70	5.08	2.23	13.08	30.07
-.075 + .053	11.22	11.08	6.81	1.63	17.10	19.17
-.053 + .045	3.22	5.00	5.98	1.71	4.31	9.08
-0.045	65.00	59.09	3.65	0.34	53.08	21.33
	100.00	100.00			100.00	100.00
	Cal. Head		4.47	0.94		

Column Test PC-10

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ .106	2.87	5.15	5.08	1.40	3.45	13.25
-.106 + .075	7.35	9.06	5.16	0.88	8.98	14.64
-.075 + .053	10.99	12.72	5.15	1.59	13.41	37.14
-.053 + .045	3.67	3.80	5.68	1.00	4.94	6.98
-0.045	75.12	69.27	3.89	0.22	69.22	27.99
	100.00	100.00			100.00	100.00
	Cal. Head		4.22	0.54		

Column Test PC-11

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ .106	13.72	14.30	9.75	0.78	36.97	25.11
-.106 + .075	12.84	12.96	4.72	0.86	16.75	25.11
-.075 + .053	10.71	10.96	4.93	0.75	14.59	18.51
-.053 + .045	2.90	2.94	3.66	0.72	3.09	4.77
-0.045	59.83	58.84	1.73	0.20	28.60	26.50
	100.00	100.00			100.00	100.00
	Cal. Head		3.62	0.44		

Column Test PC-12

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+0.045	7.80	7.10	8.40	0.80	16.30	25.36
-0.045	92.20	92.90	3.65	0.18	83.70	74.64
	100.00	100.00			100.00	100.00
	Cal. Head		4.02	0.22		

Column Test PC-13 & 14

Size (mm)	% wt. Head	Au,ppm Head	Au,% Distribution Head
+0.045	5.84	10.73	16.78
-0.045	94.16	3.30	83.22
	100.00		100.00
	Cal. Head	3.73	

Column Test PC-15

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ .075	1.69	1.29	8.39	0.34	3.70	3.16
-.075 + .053	4.15	3.65	5.25	0.90	5.68	24.16
-.053 + .045	2.82	3.76	6.56	0.57	4.83	15.71
-0.045	91.34	91.30	3.60	0.09	85.79	56.97
	100.00	100.00			100.00	100.00
	Cal. Head		3.83	0.14		

Column Test PC-16

Size (mm)	% wt. Head	% wt. Tails	Au,ppm Head	Au,ppm Tails	Au,% Distribution Head	Au,% Distribution Tails
+ .106	1.14	1.19	9.22	0.53	2.97	2.16
-.106 + .075	6.71	4.53	3.88	0.94	7.35	14.58
-.075 + .053	7.92	9.06	6.03	0.87	13.48	26.98
-.053 + .045	3.98	5.40	5.72	0.68	6.43	12.56
-0.045	80.25	79.82	3.08	0.16	69.77	43.72
	100.00	100.00			100.00	100.00
	Cal. Head		3.54	0.29		

APPENDIX 4

Beaker Agglomeration Tests Results

	Beaker Agglomeration Tests						
	1	2	3	4	5A	5B	5C
Sample:	BT-9H	BT-9H	BT-9H	BT-9H	PC-8H	PC-8H	PC-8H
Au (ppm):	3.82	3.82	3.82	3.82	3.87	3.87	3.87
% -0.045 mm:	72.9	72.9	72.9	72.9	62.7	62.7	62.7
Cement (kg/T):	10.34	11.34	12.25	12.25	10.34	10.34	10.34
Agglomerate Sol'n							
% Weight:	22.5	22.5	22.5	29	20	22	24
NaCN (g/L):	4	4	4	4	4	4	4
Cure Time (hrs)	20	20	20	20	20	20	20
Leaching							
1st Hr Sol'n mL					30	50	50
Au (ppm)							
In Sol'n	2.33	2.40	2.45	0.91	2.76	3.17	3.25
Extracted					0.83	1.59	1.63
% Extracted					21.4	41.1	42.1
Turbidity	A lot	None	None	None	Slight	None	None
2nd Hr Sol'n mL					20	48	50
Au (ppm)							
In Sol'n		1.75	1.58	0.78	1.00	1.64	1.88
Extracted					0.20	0.79	0.94
% Extracted					5.2	20.4	24.3
Turbidity	(1)	None	None	None	(1)	None	None
% Extracted (Total)					26.6	61.5	66.4

(1) agglomerate broke down, poor percolation

Beaker Agglomeration Tests

	6A	6B	6C	7A	7B	7C	8A
Sample:	PC-8H	PC-8H	PC-8H	PC-8H	PC-8H	PC-8H	BT-9H
Au (ppm):	3.87	3.87	3.87	3.87	3.87	3.87	3.82
% -0.045 mm:	62.7	62.7	62.7	62.7	62.7	62.7	72.9
Cement (kg/T):	11.34	11.34	11.34	12.25	12.25	12.25	10.34
Agglomerate Sol'n							
% Weight:	20	22	24	20	22	24	22.5
NaCN (g/L):	4	4	4	4	4	4	4
Cure Time (hrs)	20	20	20	20	20	20	20
Leaching							
1st Sol'n mL	10	50	40	10	45	55	10
Au (ppm)							
In Sol'n	1.56	3.48	3.13	1.34	3.79	2.98	1.41
Extracted	0.16	1.74	1.25	0.13	1.71	1.64	0.14
% Extracted	4.1	45.0	32.3	3.4	44.2	42.4	3.7
Turbidity	A lot	None	None	None	None	None	A lot
2nd Sol'n mL	40	48	50	25	50	42	22
Au (ppm)							
In Sol'n	1.44	1.83	1.71	2.39	1.87	1.94	0.97
Extracted	0.58	0.88	0.86	0.60	0.94	0.82	0.21
% Extracted	15.0	22.7	22.2	15.5	24.3	21.2	5.5
Turbidity	(1)	None	None	(1)	None	None	(1)
% Extracted (Total)	19.1	67.7	54.5	18.9	68.5	63.6	9.2

(1) agglomerate broke down, poor percolation

Beaker Agglomeration Tests

	8B	8C	9A	9B	9C	10A	10B
Sample:	BT-9H	BT-9H	BT-9H	BT-9H	BT-9H	BT-9H	BT-9H
Au (ppm):	3.82	3.82	3.82	3.82	3.82	3.82	3.82
% -0.045 mm:	72.9	72.9	72.9	72.9	72.9	72.9	72.9
Cement (kg/T):	10.34	10.34	11.34	11.34	11.34	12.25	12.25
Agglomerate Sol'n							
% Weight:	25	24	22.5	25	24	22.5	25
NaCN (g/L):	4	4	4	4	4	4	4
Cure Time (hrs)	20	20	20	20	20	20	20
Leaching							
1st Sol'n mL	40	50	48	50	40	40	50
Au (ppm)							
In Sol'n	2.83	2.96	3.68	3.06	3.80	4.11	2.96
Extracted	1.13	1.48	1.77	1.53	1.52	1.64	1.48
% Extracted	29.6	38.7	46.3	40.1	39.8	42.9	38.7
Turbidity	None	None	None	None	None	None	None
2nd Sol'n mL	40	50	45	50	50	50	45
Au (ppm)							
In Sol'n	2.24	1.57	1.71	1.55	1.59	1.58	1.56
Extracted	0.90	0.79	0.77	0.78	0.80	0.79	0.70
% Extracted	23.6	20.7	20.2	20.4	20.9	20.7	18.3
Turbidity	None	None	None	None	None	None	None
% Extracted (Total)	53.2	59.4	66.5	60.5	60.7	63.6	57.0

(1) agglomerate broke down, poor percolation

Beaker Agglomeration Tests

	10C	11A	11B	11C	12A	12B	12C	12D
Sample:	BT-9H	BT-15H	BT-15H	BT-15H	BT-15H	BT-15H	BT-15H	BT-15H
Au (ppm):	3.82	3.58	3.58	3.58	3.58			
% -0.045 mm:	72.9	100	100	100	100	100	100	100
Cement (kg/T):	12.25	10.34	10.34	10.34	11.34	11.34	11.34	11.34
Agglomerate Sol'n								
% Weight:	24	24	26	28	26	28	30	29
NaCN (g/L):	4	4	4	4	4	4	4	4
Cure Time (hrs)	20	20	20	20	20	20	20	20
Leaching								
1st Sol'n mL	50	10	40	40	40	55	55	60
Au (ppm)								
In Sol'n	3.46	0.18	2.84	3.56	0.63	3.63	2.90	3.04
Extracted	1.73	0.02	1.14	1.42	0.25	2.00	1.60	1.82
% Extracted	45.3	0.5	31.8	39.7	7.0	50.8	40.7	43.5
Turbidity	None	A lot	Some	Slight	A lot	None	None	None
2nd Sol'n mL	50	10	30	50		55	53	53
Au (ppm)								
In Sol'n	1.63	1.85	1.38	1.44		1.83	1.80	1.78
Extracted	0.82	0.19	0.41	0.72		1.01	0.95	0.94
% Extracted	21.5	5.3	11.5	20.1		25.6	24.2	22.5
Turbidity	None	(1)	Some	Slight	(1)	None	None	None
3rd Sol'n mL						58	50	60
Au (ppm)								
In Sol'n						0.60	0.75	0.78
Extracted						0.35	0.38	0.47
% Extracted						8.9	9.7	11.2
Turbidity						None	None	None
4th Sol'n mL						58	50	58
Au (ppm)								
In Sol'n						0.79	0.96	0.82
Extracted						0.46	0.48	0.48
% Extracted						11.7	12.2	11.5
Turbidity						None	None	None
Washing								
Au (ppm)								
Extracted							0.35	0.35
% Extracted							8.9	8.4
% Extracted (Total)	66.8	5.8	43.3	59.8	7.0	97.0	95.7	97.1
Tails						0.12	0.17	0.12
Cal Head						3.94	3.93	4.18

(1) agglomerate broke down, poor percolation

Beaker Agglomeration Tests

	12E	13A	13B	13C	14A	14B	14C	15A
Sample:	BT-15H	BT-15H	BT-15H	BT-15H	PC-14H	PC-14H	PC-14H	PC-15H
Au (ppm):		3.82						
% -0.045 mm:	100	100	100	100	94.2	94.2	94.2	91.3
Cement (kg/T):	11.34	12.25	12.25	12.25	11.34	11.34	11.34	11.34
Agglomerate Sol'n								
% Weight:	27	26	28	30	25	24	23	26
NaCN (g/L):	4	4	4	4	4	4	4	4
Cure Time (hrs)	20	20	20	20	20	20	20	20
Leaching								
1st Sol'n mL	40	58	55	42	58	42	27	44
Au (ppm)								
In Sol'n	4.77	3.58	3.60	3.67	2.35	2.29	0.21	2.96
Extracted	1.91	2.08	1.98	1.54	1.36	0.96	0.06	1.30
% Extracted	41.4	54.5	51.7	43.3	37.7	25.7		37.4
Turbidity	Slight	Slight	None	None	None	None	A lot	Slight
2nd Sol'n mL	40	48	50	40	50	28		51
Au (ppm)								
In Sol'n	2.21	1.44	1.76	2.08	1.13	0.83		1.90
Extracted	0.88	0.69	0.88	0.83	0.57	0.23		0.97
% Extracted	19.1	18.1	23.0	23.3	15.8	6.1		27.9
Turbidity	Slight	A lot	Slight	Slight	None	Slight	(1)	Some
3rd Sol'n mL	45	40	52	45	50	41		53
Au (ppm)								
In Sol'n	1.48	0.61	0.87	1.05	0.48	0.53		0.90
Extracted	0.67	0.24	0.45	0.47	0.24	0.22		0.48
% Extracted	14.5	6.3	11.8	13.2	6.6	5.9		13.8
Turbidity	Slight	A lot	Slight	Slight	None	Slight		None
4th Sol'n mL	40		50	40	47	26		50
Au (ppm)								
In Sol'n	1.38		0.68	1.09	0.55	1.57		0.51
Extracted	0.55		0.34	0.44	0.26	0.41		0.26
% Extracted	11.9		8.9	12.4	7.2	11.0		7.5
Turbidity	Slight	(1)	Slight	Slight	Slight	Slight		None
Washing								
Au (ppm)								
Extracted	0.44				0.28	0.97		0.23
% Extracted	9.5				7.8	25.9		6.6
% Extracted (Total)	96.4	78.9	95.4	92.2	75.1	74.6		93.2
Tails	0.16		0.18	0.28	0.9	0.95		0.24
Cal Head	4.61		3.83	3.56	3.61	3.74		3.48

(1) agglomerate broke down, poor percolation

Beaker Agglomeration Tests

	15B	15C	16A	16B	16C	17A	17B	17C
Sample:	PC-15H	PC-15H	PC-16H	PC-16H	PC-16H	PC-16H	PC-16H	PC-16H
Au (ppm):								
% -0.045 mm:	91.3	91.3	80.3	80.3	80.3	80.3	80.3	80.3
Cement (kg/T):	11.34	11.34	11.34	11.34	11.34	11.34	11.34	11.34
Agglomerate Sol'n								
% Weight:	27	28	24	26	25	25	25	25
NaCN (g/L):	4	4	4	4	4	1	2	4
Cure Time (hrs)	20	20	20	20	20	20	20	20
Leaching								
1st Sol'n mL	53	50	43	71	65	36	31	43
Au (ppm)								
In Sol'n	2.67	2.60	2.85	2.63	2.98	2.84	4.22	3.12
Extracted	1.41	1.30	1.22	1.87	1.94	1.02	1.31	1.44
% Extracted	44.8	36.0		49.3	44.0	30.9	33.9	40.6
Turbidity	None	None	A lot	None	None	None	None	None
2nd Sol'n mL	51	48		53	58	31	44	51
Au (ppm)								
In Sol'n	1.42	1.72		1.11	1.45	2.55	2.11	1.63
Extracted	0.72	0.83		0.59	0.84	0.79	0.93	0.83
% Extracted	22.9	23.0		15.6	19.1	23.9	24.1	23.4
Turbidity	Slight	None	(1)	Some	None	Slight	None	None
3rd Sol'n mL	47	69		57	51	30	40	40
Au (ppm)								
In Sol'n	0.70	0.59		0.72	0.91	1.33	1.16	0.68
Extracted	0.33	0.41		0.41	0.46	0.40	0.46	0.27
% Extracted	10.5	11.4		10.8	10.4	12.1	11.9	7.8
Turbidity	None	None		Some	None	A lot	None	None
4th Sol'n mL	34	42		51	52	47	43	40
Au (ppm)								
In Sol'n	0.52	0.69		0.72	0.82	1.11	1.60	1 58
Extracted	0.18	0.29		0.37	0.42	0.52	0.69	0.63
% Extracted	5.7	8.0		9.8	9.5	12.1	17.9	17.7
Turbidity	None	None		Some	None	A lot	None	None
Washing								
Au (ppm)								
Extracted	0.26	0.3		0.24	0.26	0.52	0.21	0.15
% Extracted	8.3	8.3		6.3	5.9	6.4	5.4	4.2
% Extracted (Total)	92.2	86.7		91.8	88.9	87.3	94.0	93.5
Taila	0.25	0.48		0.31	0.49	0.42	0.26	0.23
Cal Head	3.15	3.61		3.79	4.41	3.30	3.86	3.55

(1) agglomerate broke down, poor percolation

Beaker Agglomeration Tests

	18A	18B	18C	18D	18E	19A	19B
Sample:	PC-16H	PC-16H	PC-16H	PC-16H	PC-16H	PC-16H	PC-16H
Au (ppm):	3.60	3.60	3.60	3.60	3.60	3.60	
% -0.045 mm:	80.3	80.3	80.3	80.3	80.3	80.3	80.3
Cement (kg/T):	-	5.67	2.83	8.51	-	5.67	8.51
Fly Ash(kg/T):	11.34	5.67	8.51	2.83	11.34	-	-
CaSO4 (kg/T):	-	-	-	-	-	5.67	2.83
Agglomerate Sol'n							
% Weight:	25	25	25	25	26	25	25
Leaching							
1st Sol'n mL	14	30	12	26	40	21	54
Au (ppm)							
In Sol'n	0.74	2.73	2.23	3.01	1.62	2.45	3.02
Extracted	0.10	0.82	0.27	0.78	0.65	0.51	1.63
% Extracted	2.8	22.8	7.5	21.7	18.1	14.2	43.8
Turbidity	A lot	None	A lot	None	Slight	None	None
2nd Sol'n mL							50
Au (ppm)							
In Sol'n							1.44
Extracted							0.72
% Extracted							19.4
Turbidity	(1)	(1)	(1)	(1)	(1)	(1)	Slight
3rd Sol'n mL							48
Au (ppm)							
In Sol'n							0.96
Extracted							0.46
% Extracted							12.4
Turbidity							Slight
4th Sol'n mL							40
Au (ppm)							
In Sol'n							0.90
Extracted							0.36
% Extracted							9.7
Turbidity							Slight
Washing							
Au (ppm)							
Extracted							0.22
% Extracted							5.9
% Extracted (Total)							91.2
Tails							0.33
Cal Head							3.72

(1) agglomerate broke down, poor percolation

Beaker Agglomeration Test

	20A	20B	21A	21B	21C
Sample:	PC-13H	PC-13H	PC-15H	PC-15H	PC-15H
Au (ppm):					
% -0.045 mm:	94.2	94.2	91.3	91.3	91.3
Cement (kg/T):	10.34	9.20	11.34	11.34	11.34
Agglomerate Sol'n					
% Weight:	25	25	28	28	27
NaCN (g/L):	4	4	1	2	4
Cure Time (hrs)	20	20	20	20	20
Leaching					
1st Sol'n mL	64	39	51	52	44
Au (ppm)					
In Sol'n	3.12	3.43	2.53	2.54	2.90
Extracted	2.00	1.34	1.29	1.33	1.28
% Extracted	50.5	36.7	40.4	41.1	37.3
Turbidity	None	Slight	None	None	None
2nd Sol'n mL	61	37	54	42	50
Au (ppm)					
In Sol'n	1.28	1.[illegible]	1.10	1.41	1.72
Extracted	0.78	0.50	0.59	0.59	0.86
% Extracted	19.7	13.7	18.5	18.2	25.1
Turbidity	None	Slight	Slight	None	None
3rd Sol'n mL	52	40	52	45	50
Au (ppm)					
In Sol'n	0.68	1.50	0.88	1.02	0.98
Extracted	0.35	0.60	0.46	0.46	0.49
% Extracted	8.8	16.4	14.4	14.2	14.3
Turbidity	None	Slight	Slight	None	None
4th Sol'n mL	48	35	47	45	51
Au (ppm)					
In Sol'n	0.65	1.77	1.02	1.09	1.29
Extracted	0.31	0.62	0.48	0.49	0.66
% Extracted	7.8	17.0	15.0	15.1	19.2
Turbidity	None	Slight	Slight	None	None
Washing					
Au (ppm)					
Extracted	0.06	0.17	0.10	0.15	0.10
% Extracted	1.5	4.7	3.1	4.6	2.9
% Extracted (Total)	82.4	87.8	91.5	93.2	93.6
Tails	0.46	0.42	0.27	0.22	0.22
Cal Head	3.96	3.65	3.19	3.24	3.43

(1) agglomerate broke down, poor percolation

Beaker Agglomeration Test

	22A	22B	22C	22D	22E	22F	22G
Sample:	PC-15H	PC-15H	PC-15H	PC-15H	PC-15H	PC-15H	PC-15H
Au (ppm):							
% -0.045 mm:	91.3	91.3	91.3	91.3	91.3	91.3	91.3
Cement (kg/T):	11.34	11.34	11.34	11.34	11.34	11.34	11.34
Agglomerate Sol'n							
% Weight:	27	27	27	27	27	27	27
NaCN (g/L):	4	4	4	4	4	4	4
Cure Time (hrs)	14	8	4	6	8	10	12
Leaching							
1st Sol'n mL	65	59	56	65	49	66	60
Au (ppm)							
In Sol'n	2.50	1.60	2.27	2.17	2.12	2.60	2.93
Extracted	1.63	0.94	1.27	1.41	1.04	1.72	1.76
% Extracted	47.4	27.6	34.1	37.5	34.8	49.9	49.7
Turbidity	None	None	None	None	None	None	None
2nd Sol'n mL	64	57	47	60	38	66	51
Au (ppm)							
In Sol'n	1.23	1.43	1.45	1.27	1.25	1.02	1.55
Extracted	0.79	0.82	0.68	0.76	0.48	0.67	0.89
% Extracted	23.0	24.1	18.3	20.2	16.0	19.4	22.3
Turbidity	None	None	A lot	Slight	Slight	Slight	Slight
3rd Sol'n mL	45	50	45	61	48	55	48
Au (ppm)							
In Sol'n	0.70	0.95	0.85	0.76	1.51	0.68	0.75
Extracted	0.32	0.48	0.38	0.46	0.73	0.37	0.36
% Extracted	9.3	14.1	10.2	12.2	24.4	10.7	10.1
Turbidity	None	None	A lot	Slight	Slight	Slight	Slight
4th Sol'n mL	44	50	44	45	28	45	37
Au (ppm)							
In Sol'n	0.58	1.13	1.13	1.02	1.40	0.67	0.74
Extracted	0.26	0.57	0.50	0.46	0.39	0.30	0.27
% Extracted	7.6	16.8	13.4	12.2	13.0	8.7	7.6
Turbidity	None	None	A lot	Slight	Slight	Slight	Slight
Washing							
Au (ppm)							
Extracted	0.18	0.20	0.23	0.24	0.1	0.17	0.14
% Extracted	5.2	5.9	6.2	6.4	3.3	4.9	4.0
% Extracted (Total)	92.5	88.5	82.3	88.5	91.6	93.6	93.7
Tails	0.26	0.39	0.66	0.43	0.25	0.22	0.22
Cal Head	3.44	3.40	3.72	3.76	2.99	3.45	3.54

(1) agglomerate broke down, poor percolation